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GAINS IN EXPORT TRADE.

For both September and October the figures of export trade are distinctly encouraging, and the gross totals for the elapsed portion of the year are equally good. It appears that in September the exports of electrical machinery were $658,831, as compared with $578,246 a year ago, and that the exports of electrical instruments and supplies were $841,769, as compared with $762,152. The same trend is seen in the data for October just to hand. The exports of electrical machinery were $583,000, as compared with $514,184, and of instruments and apparatus were $851,650, as compared with $780,233. It will be noted that there are fluctuations, but that the goods of smaller bulk continue, as for a long time past, to exceed in value the heavier dynamos, motors, etc. The reason for this is not quite clear, and as far as we are aware the subject has never been investigated as a broad proposition by those most deeply interested—the manufacturers. If there were a greater subdivision of the returns it might be helpful; but when, out of the total of $851,650 for instruments in October, we are told that $58,763 was for telephones and $6,169 for telegraphs, we are certainly left in rather blind conjecture as to what the other nine-tenths—$786,718—consisted of, and might vainly do a lot of fancy guessing on the subject. Moreover, it would be interesting to know if the foreign business is widely distributed throughout the industry or is confined in large part to a relatively few companies having also European works.

All told, the figures for the ten months this year are indicative of a distinct revival in trade, of which, indeed, there are now clearer proofs than were obtainable during the spring and summer. The total exports of electrical instruments for the ten months of this year are $8,883,694, a gain of more than $3,000,000 over the corresponding period of 1909 and $750,000 better than that of 1910. In like manner exports of electrical machinery were $6,713,063, a gain of $1,700,000 over the period in 1909 and nearly $1,000,000 over 1910. There can hardly be any doubt or question as to the hopeful meaning of such statistics.

THE 11,000-KW BOILERS OF THE DETROIT EDISON COMPANY.

Ever since the early days of the Detroit Delray station, when the manufacture of salt was planned there as a by-product of electrical generation, this unusual plant has presented many interesting departures in design and operation. But most recent and remarkable of these, as described on following pages, is the pioneer use at Delray of huge water-tube boilers, any one of which is capable of supplying for short periods steam turbine loads up to 11,000 kw. Each of these great steaming units is rated at 2365

boiler hp, on the absurd and outgrown basis of 10 sq. ft. of heating surface per hp, or 30 lb. of steam per hp-hour. Such a definition remains, of course, only as a memento of the days of the inefficient non-condensing engines and is practically meaningless in discussing the steam consumption of modern large turbines of the type at Delray, which deliver a kilowatt-hour on 15 lb. of steam. Boiler practice, too, has advanced until the operation of boilers at several hundred per cent of their normal full load on the old basis of 10 sq. ft. per hp is now regarded as entirely conservative and tending toward the highest efficiency. The Delray boilers have been tested up to 214 per cent of full load, which is equivalent to generating steam at about 7 lb. per hour per square foot—not an excessive evaporation for boilers in modern practice. Ordinarily the Delray units, of which there are five erected and five more to be installed, carry 6000 kw to 7000 kw each. This load increases to 8000 kw per boiler during the peak periods, and for short durations has reached 11,000 kw without any appearance of distress. The confusion in boiler ratings which makes possible such a paradoxical statement as the foregoing, that these 2365-hp boilers can furnish 11,000 kw at 100 per cent overload, points to the need for a new measure of boiler capacity.

But, rated at 2365 hp or 11,000 kw, the Delray boilers are really prodigious units, as a glance at their dimensions will show. Each boiler is 36 ft. high, 30 ft. wide and 28 ft. deep, being fired from both ends. The three huge steam drums are connected with the two mud drums by no less than 1564 3¼-in. tubes. Each boiler has four water-columns and an even dozen safety valves designed to relieve pressure rises above the normal steam condition of 205 lb. pressure and 150 deg. superheat. But more significant than the mere size of these great boilers is the economy of performance which they have revealed, reaching efficiencies probably higher than those yet reported on any other units using coal containing a high percentage of volatile matter. At normal rating these big units showed a combined thermal efficiency of 80 per cent (about 89 per cent being the maximum possible value), and this observed efficiency decreased only to 76 per cent at 100 per cent overload. The remarkable economies obtained can hardly be traced to exceptional flue temperatures or any other furnace conditions differing materially from ordinary experience. But the big units decrease the usual proportion of radiation losses, and with their single huge fires enable the closest attention to be given to but the one bed which is the equivalent of a whole roomful in an ordinary plant. Labor costs are thus reduced correspondingly, and the boiler-room layout is simplified and cheapened. The boilers themselves cost less per unit of rating than similar small units. Difficulties with furnace brickwork in the big boilers have apparently been solved as rapidly as they presented themselves. And, in answer to the question which is most likely to rise in the mind of the practical operator, one may retort by asking whether boiler units embodying 11,000 kw of steaming capacity are to arouse any serious fears of "too much concentration of power" in these days of 20,000-kw turbines and generators.

There are other things at Delray to interest the mechanical man besides the big boilers. Differing from earlier experience elsewhere, here 14,000-kw turbo-generators are ventilated with superior success directly from the engine-room, their discharge ducts leading outside the building. Several new 9000-kw turbines have their auxiliaries motor-driven, steam being bled from an intermediate turbine stage to heat the feed water. Closed heaters are used in this connection, combined four-stage centrifugal pumps delivering from the hot-wells clear through the heaters and economizers, and into the boilers "at one fell swoop." The pressure systems of both the oil and water step bearings are operated with a single accumulator, the two systems being connected by proportional pistons which adjust all variation. The high-pressure steam fittings are of an English gate type, little known in this country, in which the steam passage at the closure is constricted to one-half the diameter and consequently one-fourth the area of the corresponding pipe. The valve gate is thus traversed at high velocity, the steam regaining its pressure head on expanding into the following cone chamber. Such valves, it is declared, are light, cheap in spite of tariff duty and easily operated by one man.

DISTRIBUTION OF POWER IN LONG-DISTANCE TELEPHONE CIRCUITS.

The amount of power which is developed in a long-distance telephone circuit is so small that it is commonly ignored. Nevertheless, it exists, and upon its magnitude and distribution depends the practical success of a telephone circuit. The telephone excitation current and power come from the storage battery in the telephone central station, but the power of telephonic speech has to be developed in the transmitter by the action of the human voice. Up to the present time no means has been brought into service for enhancing the power generated in the microphone so as to extend in this manner the range of telephony. By loading a telephone circuit its range can be increased two-fold or threefold. If this is not enough, more copper must be used; but if the microphone could supply the exciter circuit of a generator driven by power so as to deliver at the generator terminals a magnified replica in voltage of the speech currents through the transmitter the telephonic range could be increased a hundredfold or more.

As has been mentioned in the *Digest*, some interesting measurements are reported in the *Elektrotechnische Zeitschrift*, by Herr F. Breisig, on the voltage, current and power in a simple telephone circuit. In a particular case the power received was 50 microwatts, of which 9.2, or 18.4 per cent, was absorbed by the telephone. By far the greater part of the power absorbed by the telephone is converted as I^2R into heat in the winding, and only a small portion is available as mechanical power for exciting air vibrations in the cavity of the listener's ear. It is shown that a relatively large amount of power is lost in the carbon transmitter during the operation of listening and when the transmitter is out of service. In fact, nearly four times as much power was absorbed in the resistance of the transmitter as was absorbed in the receiver. Nevertheless, it is not worth while complicating the apparatus with auto-

matic or semi-automatic switches to introduce the transmitter only when talking. Finger-operated button switches used to be furnished at one time for this purpose in long-distance telephone sets, but they were found to be more trouble than they were worth. A difficulty mentioned in the paper with all such measurements is that the telephone transmitter microphone does not maintain at all times a constant resistance. Nevertheless, measurements of this kind supply very welcome information.

REGULATED AND PROTECTED MONOPOLY.

In his recent address before the N. E. L. A. section in Chicago Mr. H. M. Byllesby said in substance that public opinion in this country is rapidly crystallizing in the idea that a public utility should be a regulated and protected monopoly. This is no news to those who have been following the trend of public thought and legislation, but it expresses concisely a gratifying fact. While it is too much to expect that the regulation of public-utility companies in the future will be accomplished altogether without friction, or that the commissions charged with the responsibility of such regulation will always be ideal in their make-up, yet unquestionably there is now general recognition of the principle that competition in public utilities is not a suitable means for checking corporate abuses and is both damaging to the capitalist and a general nuisance to the public. While regulation of this kind has been properly provided for in only a few states, it is certain that legislation providing for public-utility commissions will be passed in a large number of the states during the next few years. Not only is the regulation idea to be applied to public utilities, but the growing sentiment regarding federal and corporation laws and the conduct of present industrial constructions under proper regulation is also becoming one of the live questions of the day.

THE ADJUSTABLE-SPEED ALTERNATING-CURRENT MOTOR.

The reasons usually advanced for selecting the direct-current in preference to the alternating-current system under modern industrial conditions are based on the superior flexibility of the motor speed control of the former. Advocates of the latter contend that the constant-speed alternating-current motor is a much better machine than the constant-speed direct-current motor, and that since by far the larger number of machines in use are employed in constant-speed service it is apparent that the choice between the two systems is to be determined largely by the merits of the available types of variable-speed motors. It is also pointed out that the highly successful performance of the single-phase motor in railway service furnishes conclusive evidence that for any problem involving the use of motors possessing "series" characteristics alternating-current motors offer a solution quite as satisfactory as direct-current motors. Nevertheless, when comparing the two distinctive types of motors available for adjustable-speed service, it cannot be denied that the modern direct-current motor is greatly superior to the best alternating-current motor thus far developed. A point of much interest in this connection was brought forward in a paper presented by Mr. Gus A. Maier before the American Institute of Electrical Engineers on Dec. 8, namely, that an adjustable-speed alternating-current motor can be even inferior to the direct-current motor and yet effectively supplant the latter machine. This condition is attributable to the desirability of eliminating the economic necessity of employing direct-current motors throughout an industrial establishment because a few of the total number must be of the adjustable-speed type. The advantages attending the abolition of apparatus for transforming from alternating to direct current, and the use of a large number of induction motors rather than direct-current shunt motors for constant-speed service, would, in the opinion of the author, outweigh the relative disadvantages of the somewhat poorer adjustable-speed alternating-current motor substituted for the few adjustable-speed direct-current motors.

If one were permitted to ignore the requirements of commutation he could state with some confidence that the adjustable-speed alternating-current type of motor may be built and operated more satisfactorily than a motor of the direct-current type. This statement would be based on the fact that the stationary transformer affords a convenient and economical device for voltage variation which has no counterpart in direct-current equipment. The field-magnetism and armature-voltage variation methods of speed adjustment can be applied to alternating-current commutator motors with results which are identical with those obtained with direct-current motors. The correct time-phase relation between the armature current and the field magnetism can be absolutely insured by impressing across the field coils an emf 90 time-degrees displaced from the emf impressed across the armature; that is, by connecting the field coils across one phase, and the armature across another phase, of a two-phase system. Such a motor can be accelerated from rest with the maximum value of torque per armature ampere by the use of a non-inductive rheostat, such as is employed with direct-current motors, while speed adjustment can be obtained by varying the voltage across either the field coils or the armature. A disadvantage of this type of motor resides in the transformer emf produced in the coil short-circuited by the brush, which renders the commutation unsatisfactory in the simplest form of the motor. Commutation difficulties can be minimized by introducing a counteracting emf, or reducing the current produced in the short-circuited coil by internal or external resistance leads. Another method of minimizing the commutation troubles consists in introducing the electrical energy into the armature inductively rather than conductively by utilizing the so-called repulsion principle. In the simple form of the repulsion machine, with the energy brushes short-circuited, the commutation difficulties disappear at synchronous speed, and at all speeds they are less than in the above-mentioned adjustable-speed motor, even when the change in speed is produced by introducing an emf in the energy circuit. Commutation troubles have not yet been completely eliminated, but it is not too much to expect a rapid improvement along this line as experience is gained with motors now being developed and as inventors and investigators realize more and more the importance of producing an alternating-current motor suitable for competing favorably with the adjustable-speed direct-current machine.

American Institute of Electrical Engineers Affairs.

The following account of the business done at the December meeting of the board of directors of the American Institute of Electrical Engineers illustrates the wide range of activity of that organization and the large quantity of work of importance disposed of monthly at the meetings of its governing body and carried on by the various committees. The policy whereby the internal management of the Institute now receives full publicity enables the high value of that body to the electrical profession to be appreciated to an extent that was impossible in the past.

At the meeting sixty-eight associates were elected, 110 students enrolled, and six associates transferred to the grade of membership. The action at the November meeting providing an appropriation for defraying the expenses of the "smoker" following the regular New York City monthly session was reconsidered, owing to danger of establishing a precedent with respect to expenditures by local sections and branches; instead, a reception committee was provided for, which will receive voluntary contributions to meet the expenses of the monthly "smokers." The expense of the December "smoker," the first held, was provided for in this manner.

On recommendation of the historical museum committee, the Institute extended its thanks to Mrs. Sidney H. Short for a bronze bust of her late husband, in a resolution expressing in fitting terms appreciation of the gift, which was accepted "in grateful memory of the personal qualities and distinguished accomplishments of an early member of the Institute, who contributed to many electrical arts as an inventor and to the development of electrical engineering in the United States and Great Britain."

ANNUAL AND OTHER MEETINGS.

A resolution was adopted providing that the annual convention of the Institute shall be held in Boston during the latter part of June, 1912, the exact dates to be determined later. The electrochemical committee has arranged for an electrochemical session during the convention. Another resolution provides that the date of the April Institute meeting in New York be advanced one week, making the date April 5 instead of April 12; also that an industrial-power meeting be held in Pittsburgh on April 25-27, under the auspices of the Pittsburgh Section.

The railway committee is organizing a special electric railway meeting for April 5, which, on account of the length of the program, will probably require an afternoon in addition to an evening session.

THE METRIC SYSTEM; REVISION OF STANDARDIZATION RULES.

A resolution was passed reciting that the board of directors regards it as desirable that the international metric system of weights and measures be more generally used in engineering literature in this country and directing that in all papers, reports and publications of the Institute measures expressed otherwise than in the metric system shall be accompanied by metric equivalents in parentheses, and that all the Institute committees affected be directed to carry out this instruction.

Dr. C. P. Steinmetz and Mr. B. G. Lamme were appointed a separate committee to collect material looking to the next revision of the standardization rules.

PANAMA VISIT.

The Panama committee reported desirable arrangements for accommodation on two steamers to the Isthmus, one from New York on Jan. 17 and another from New Orleans on Jan. 20, adding that although reservations have been rapidly taken up a few are yet available. Owing to the impossibility of President Dunn accompanying the party, a resolution was adopted designating Manager S. D. Sprong as the official representative of the Institute in connection with the visit.

AMENDMENTS TO CONSTITUTION AND BY-LAWS.

The amendment to the constitution providing for the election of the secretary of the Institute by the board of directors, which failed last year because it received only 70 per cent of the vote cast, whereas 75 per cent was necessary for adoption, was again discussed. The board decided to resubmit this amendment to the membership because of the large majority in favor of it and because its failure to receive the necessary three-quarters majority last year was considered to have been due to some misunderstanding.

The president brought up again the modification in the method of making nominations which he had presented to the meeting of section officers at the Chicago convention, which modification had been formulated by Acting Secretary Hutchinson. He called attention to the desirability of adding to the present system of nominating officers the feature of advance nomination by petition, so that when the nominating forms go out on Feb. 1 the members will have some guide as to possible candidates, with the result of a concentration in what is at present the extremely large scattering vote. So large has been the scattering vote in connection with nominations for manager that last year it was distributed among 581 different candidates, and as a result of such scattering the manager heading the list received only 4.8 per cent of the vote of the membership. The addition to the present nominating system consists merely in publishing at the time the nominating ballots go out the names of all candidates in favor of whom a petition of fifty names, or the separate indorsement of fifty names, has been received at Institute headquarters prior to Jan. 25. This arrangement is covered by a by-law adopted to supersede Section 18 of the present by-laws, as follows:

"In addition to the names of the incumbents of office, the secretary shall publish on the 'form showing offices to be filled at the ensuing annual election in May,' provided for in Article VI, Section 30, of the constitution, the names, as candidates for nomination, of such members and associates of the Institute as have been proposed for nomination for a particular office by the petition or by the separate indorsement of not less than fifty members or associates, received by the secretary of the Institute in writing by Jan. 25 of each year.

"The names of such candidates for nomination shall be grouped alphabetically under the name of the office for which each is proposed, and this by-law shall be reprinted prominently in the January issue of each year's *Proceedings* and shall be reproduced on the form above referred to."

FRATERNAL RELATIONS WITH OTHER SOCIETIES.

In the last few years so many matters have come up of common interest to the four national engineering societies that lack of an effective co-operation between them has been felt. In order to secure this, and on the suggestion of Past-president Col. E. D. Meier, of the American Society of Mechanical Engineers, President Dunn recommended that the board of directors authorize a conference committee to deal with inter-society matters. The board therefore adopted a resolution authorizing the president to designate the chairman and one other member of the public policy committee as members on the part of the American Institute of Electrical Engineers of a joint conference committee of the national engineering societies. The duty of the members of the conference committee shall be to meet and confer with corresponding members from the other societies on the call of any one of them and to inform the board of directors of matters that are considered to be of interest to the group of national engineering societies as a whole, and to make such recommendations as the conferees think advisable to guide specific action by the American Institute of Electrical Engineers.

President Dunn asked the board to authorize him to communicate with the leading foreign electrical engineering societies with reference to the mutual establishment of

visiting-member privileges, so that members of the American Institute of Electrical Engineers visiting foreign countries may, upon the presentation of proper credentials from the secretary, have the privilege of temporary membership in the society of the foreign country; in return, members of foreign electrical engineering societies visiting the United States to have the privileges of the facilities afforded by the American Institute of Electrical Engineers in New York and in other cities of the United States; these visiting-member privileges to be in the nature of guest privileges in a club. In addition to the personal convenience thus afforded to members of the electrical engineering profession all over the world, the relation would serve as a bond of friendship and inducement to more frequent intercourse among electrical engineers. The board authorized the president to learn the attitude in the matter of the foreign electrical engineering societies.

NEW GRADE OF MEMBERSHIP.

The chairman of the intermediate grade of membership committee presented amendments to the constitution providing for an additional grade of membership in the Institute. The features of the plan are: First, making three grades of membership where there are now two; second, arranging that the highest grade shall be slightly higher than the present grade of member, and that practically all the present members shall be automatically transferred thereto; third, arranging that the intermediate grade shall be somewhat lower than the present grade of member, and that such of the associates (who now number 90 per cent of the Institute membership) shall be automatically transferred thereto whose records on file justify such transfer, the expectation being that about half of the present associates will thereby become members; fourth, giving to the vote of such associates as shall be transferred and to the vote of such members as are in the highest grade an increased weight; fifth, that the status of those who remain associates shall be exactly as at present.

The names for the three grades have not been finally decided upon, but those suggested are, for the highest grade, "fellow," for the next grade "member," and for the third grade "associate." The Institute is the only large engineering society whose membership is limited to two grades, and the fact that only 10 per cent of the membership of the Institute is in its first grade, which is called that of "member," and which prevents the use of the name member by a very large proportion of the total membership of the Institute, is an anomaly. An additional grade of membership to meet the condition now under consideration by the Institute has been established in all the great engineering societies in response to the demand of their membership, and it is felt that the present amendments, if adopted, will add greatly to the Institute's solidarity. The board of directors provisionally adopted the amendments, and will consider them for final adoption at its next meeting, the committee in the meantime being authorized to make recommendations for modifications in detail.

REPORTS OF COMMITTEES.

The public policy committee reported that Chairman Stott, Messrs. Stillwell, Townley and Finney and President Dunn had presented to the National Waterways Commission at Washington, D. C., on Nov. 21 and 22, the brief on water-powers prepared by the committee; that the Institute representation had been most successful and had added to the Institute's standing and prestige; that the water-power report had been published in the electrical press, and that requests for additional copies were constantly coming, necessitating the printing of two new editions.

The committee on indexing the *Transactions* of the Institute reported the completion of synopses of five years' *Transactions*.

The code committee is at work on the question of grounding secondary circuits.

Three meetings of the code of ethics committee have been held. A rough draft of a new code has been completed and will come up for final discussion at the committee's next meeting, after which it will be sent out for the opinion and revision of the advisory members appointed by the president after the last meeting of the board.

Report of Railroad Securities Commission.

The report of the Railroad Securities Commission has been transmitted to Congress by President Taft. The President concurs in the recommendations made by the commission and urges that proper action be taken to carry them into effect. The commission is composed of Messrs. Arthur T. Hadley, chairman; Frederick N. Judson, Frederick Strauss, Walter L. Fisher, Balthasar H. Meyer and William E. S. Griswold, secretary.

The report of the commission is a brief discussion with conclusions on a number of points which are in controversy in the present railroad situation. The discussions and recommendations apply generally to all agencies of communication and transportation enumerated in the act to regulate commerce. Two of the principal points developed by the commission are the need of publicity respecting the affairs of the corporations and the necessity of an attitude on the part of public authorities that will attract the capital required for railroad development. The commission believes that, so far as the immediate action of Congress is concerned, stringent provisions regarding publicity of stock and bond issues, which will show how far the laws are obeyed and will enable the federal government to hold the railroad officials responsible for the consequence of not obeying them, will be more salutary and more effective than any new statutory demands. It is also believed, however, that the time is near when the difficulties of the present system of complex control by state and federal governments, and the conflict of state laws, will become so manifest that further legislation on the subject will be imperative.

The commission, in speaking of the tendency of the public to misunderstand the conditions of stock issues, states that this tendency has led lawmakers to lay too much stress on keeping down the nominal amount of stock and too little upon getting the actual amount of capital needed and having it properly used. It is believed by the commission that authorization of securities by a commission would tend to create the impression on the part of the investing public of a guaranty or official recognition of values, which no administrative authority can safely give. The absence of such recommendation by the commission is intended to make it clear that no such guaranty should be given.

There is an essential community of interest between the shipper and investor, and it is folly to attempt to protect the one by taking away the rewards of good management from the other. A reasonable rate of return is one which, under honest government and responsible management, will attract the amount of investors' money needed for the development of railroad facilities. The substitution of electricity for steam is but a type of the many changes which railroads may be compelled to make, any one of which might involve large additions to their cost without the assurance of corresponding additions to their return.

Hydroelectric Progress in Deerfield Valley, Mass.

The New England Power Company is now building four hydroelectric developments in the Deerfield River valley, in Massachusetts, which represent an ultimate investment of about $4,000,000 and the annual production of about

60,000,000 kw-hours of primary and 30,000,000 kw-hours of secondary energy. The work includes four generating plants in the Shelburne Falls-Greenfield district, with hydraulic works and a storage reservoir at Peck's Mill, Vt., which will have a capacity of 2,500,000,000 cu. ft. The system will be interconnected with that of the Connecticut River Transmission Company, and will supply power from the New York state line eastward to Marlborough, striking within 30 miles of the Boston district. It is expected that the electric train service of the Hoosac tunnel will be operated by Deerfield River power, the existing Zylonite steam plant of the Boston & Maine Railroad being held as a reserve.

It is expected that by Jan. 15 a 66,000-volt, three-phase steel-tower transmission line will be completed between the South Vernon (Vt.) plant of the Connecticut River company and the plant sites near Shelburne Falls. Power from the former source will be utilized in construction work, the present supply being derived from the Greenfield Electric Light & Power Company's system. The first plant to be completed is now under construction at Scott's Bridge. Water will be diverted from the river by a concrete dam and carried to the plant by a 1700-ft. concrete-lined tunnel discharging into a forebay from which three 10-ft. steel penstocks will connect with the waterwheels, about 8000 hp being available under 65-ft. head. A cofferdam has been built at the power-house site, and work is progressing on foundations. The station is to be completed by September, 1912, the work being handled by the Fraser-Brace Company, New York.

At Shelburne Falls, near the Gragg estate, a similar development is being built by Fred T. Ley, Inc., Springfield, Mass. About a mile below the existing plant of the Greenfield company at Gardner Falls the Fraser-Brace Company is building a third plant of about the capacity of the foregoing, under a 60-ft. head. Preliminary work only has been done as yet upon the fourth proposed plant, which will be located at Bardwell's Bridge, near Greenfield, and contracts have not yet been closed for this installation. The storage reservoir in Vermont will have an area of about 1800 acres, and will be provided with an earth dam 1 mile long, 100 ft. high and 500 ft. thick at the base. Actual construction will shortly be commenced. The general work of construction is being handled by the Power Construction Company, of Shelburne Falls, Mass. Associated with this organization as consulting engineers are Messrs. J. G. White & Company, New York; Charles T. Main, Boston, and F. P. Stearns, Boston. The water rights and franchises on the Deerfield River were acquired by Chace & Harriman, Inc., Boston, who have general supervision of the project. The securities are being underwritten by Baker, Ayling & Company, Chace & Harriman, Inc., and Estabrook & Company, Boston, and W. R. Grace & Company and Henry Phipps, New York.

Discussion of Rubber Specifications.

Mr. E. B. Katte, chief engineer of electric traction of the New York Central Railroad, recently invited a number of prominent manufacturers, consumers and chemists to a conference at which the subject of rubber specifications was discussed with a view to action for securing uniformity in rubber analysis.

The chief consideration that led to the conference was the belief that the art of analyzing rubber compounds has not reached the state of perfection which the commercial importance of rubber products seems to warrant. Various chemists have developed methods of analysis possessing more or less merit, but at the present time these methods cannot be relied upon to give concordant results. Users of rubber-insulated wire are particularly interested in the analysis of rubber compounds owing to the recent practice of inserting chemical clauses into specifications. The manufacturers are equally interested because in the present state of the art they are likely to have insulation refused by their customers, not because it is defective, but because some unforeseen method of chemical analysis indicates that the specifications have not been complied with. Chemists are interested not only in the scientific aspects of the problem, but also in its commercial aspects, because the chemical specification for rubber, with all it implies in its relation to chemists, will drop out of use unless the chemists are able to stand back of it with an analysis that cannot be controverted.

The conference was held on Dec. 7 at 335 Madison Avenue, the attendance including representatives of the United States Army, the New York Central Railroad, the Pennsylvania Railroad, the General Electric Company, the Standard Underground Cable Company, the Simplex Electrical Company, the Hazard Manufacturing Company, the American Chemical Society, and several chemists who have made a specialty of rubber analysis. Major Samuel Reber, U. S. A., was elected chairman, and after a discussion of the various aspects of the problem the following committee was nominated to determine a standard procedure in the analysis of rubber compounds: Messrs. H. B. Rodman, chemist Pennsylvania Railroad, Altoona, Pa.; C. R. Boggs, chemist Simplex Electrical Company, Cambridge, Mass.; W. B. Gieser, chemist New York Central Railroad, Albany, N. Y.; P. Poetschke, chemist the Lederle laboratories, 39 West Thirty-eighth Street, New York; James P. Millwood, consulting chemist, 246 Willoughby Avenue, Brooklyn, N. Y.; Wallace Clark, in charge of the wire and cable department of the General Electric Company, Schenectady, N. Y., and W. A. Del Mar, assistant engineer New York Central Railroad, New York.

The work of the committee will be largely in the nature of laboratory tests and comparison of results by correspondence and periodic meetings. Suggestions and communications will be received by the secretary, Mr. W. A. Del Mar, 335 Madison Avenue, New York.

Employees' Pension System of Baltimore Central-Station Company.

The Consolidated Gas, Electric Light & Power Company, of Baltimore, adopted a plan for pensioning employees at a meeting of the board of directors held Dec. 6, 1911, the details of which are given below:

At a meeting of the board of directors held a few months ago, upon the suggestion of President J. E. Aldred, a committee of the board was appointed to inquire into and formulate a system of pensions for the purpose of making provision for the employees of the company, who, after long years of faithful service, had reached an age when they were unequal to the further performance of their duties. The plan which has just been adopted makes provision for the following employees:

(1) Any employee who attains the age of sixty-five years after fifteen years' continuous service.

(2) Any employee who after twenty years' continuous service is by reason of permanent physical or mental disability unable to follow his usual employment in the company's service.

(3) Any employee who after ten years' continuous service shall become incapable of continuing in service by reason of injuries received while at work in the employment of the company.

The detailed plan for the application of the pension principle to the classes above mentioned is such as to result in very liberal treatment of the company's employees. It is provided that the entire cost of the pension system

shall be borne by the company, the system calling for no contributions from the employees themselves.

Before adopting the plan outlined a comprehensive survey was made of pension plans of public-service companies in this country and Europe. Endeavor was made to provide a broad, liberal and equitable plan, one which gives substantial recognition to long and faithful service to the company and the public.

The company believes that its thus voluntarily establishing a system under which continued income will be assured to those who, after years of continuous service, are because of age or infirmity no longer fitted to perform their duties will be accepted as an expression of appreciation of faithful and efficient service in the past and as an incentive for renewed effort to make the services rendered the public still more efficient and valuable.

The system, the company hopes, will increase among its employees the feeling of permanency in their occupation and cause an enlarged interest in the welfare of the company and the community which it serves and a desire on the part of employees to devote their best efforts to further the services rendered the public.

In commenting on the action of the board of directors of the company, President Aldred stated that "the adoption of a pension plan is but another step in the distinct policy of the management of the Consolidated Gas, Electric Light & Power Company, of Baltimore, to recognize its duties not only to the shareholders of the company, but to its employees and the public." The pension plan goes into effect on Jan. 1, 1912, and affects all of the company's employees, numbering about 1600.

A. I. E. E. Smoker.

Nearly 400 electrical men were the guests of the American Institute of Electrical Engineers at a smoker held in its rooms on the tenth floor of the Engineering Societies Building, New York, Friday evening, Dec. 8. The smoker was set for 10 p. m., following the meeting of the Institute, at which Mr. G. A. Maier presented a paper on adjustable-speed motors. Cigars were passed around during the evening, and sandwiches and coffee were served. This informal function was planned as the first of a series of smokers to promote social intercourse and acquaintance among New York electrical men, as well as to stimulate interest in Institute affairs. The first meeting proved a great success, the attendance being nearly twice the number expected. Voluntary subscriptions were received from members living in New York to defray the expense of the smoker.

Chicago Meeting of American Physical Society.

The regular Thanksgiving meeting of the American Physical Society was held in the theater of the Kent Chemical Laboratory of the University of Chicago on Dec. 2. About sixty members were in attendance, and a program of twenty-six short papers was discussed. Prof. W. F. Magie, of Princeton University, the president of the society, occupied the chair, and Prof. G. W. Stewart, of the University of Iowa, acted as temporary secretary in the absence of Mr. Merritt.

Among the papers relating more particularly to the science of electricity were the following: "Rays of Positive Electricity from the Wehnelt Cathode," Mr. Charles T. Knipp, University of Illinois; "The Effect of Prolonged Illumination on the Photo-electric Discharge in a High Vacuum," Messrs. R. A. Millikan and J. R. Wright, University of Chicago; "An Absolute Determination of the Minimum Ionizing Energy of an Electron, and the Application of the Theory of Ionization by Collision to Mixtures of Gases," Mr. Edwin S. Bishop, University of Chicago; "Oscillatory Discharge of a Leyden Jar," Mr. R. R. Ramsey, Indiana University; "A Method of Measuring the Effective Capacity of High-Tension Cables," Messrs. G. W. Stewart and D. M. Terwilliger, University of Iowa; "Electrostatic Induction in Long Lines," Mr. Carl Kinsley, University of Chicago; "The Application of the Potentiometer Method to the Determination of the Curve of Decay of the Counter Electromotive Force of the Aluminum Rectifier," Mr. C. W. Green, Albion College; "Effect of Frequency on the Capacity of a Condenser with Kerosene for the Dielectric, and the Limits of the Wheatstone Bridge in Measuring Small Capacities," Mr. S. Herbert Anderson, University of Illinois; "The Number of Ions Produced by an Alpha Particle from Polonium," Mr. T. S. Taylor, University of Illinois.

N. E. L. A. Rate Research Committee.

At the meeting of the rate research committee of the National Electric Light Association held at association headquarters in New York on Dec. 8 there were present Mr. E. W. Lloyd (chairman), of Chicago; Messrs. R. S. Hale, of Boston; L. H. Conklin, of Scranton; S. E. Doane, of Cleveland; R. A. Philip, of Boston, and W. J. Norton (secretary), of Chicago. Mr. John F. Gilchrist, president of the N. E. L. A. and chairman of the rate research committee reporting at the last convention, was present also. The work of the committee is being developed in relation to the following subjects: History of rates; court decisions relative to electric-light rates; history of government regulation; definitions; rate preparation, and comparative rates. The study relates less to actual rates as expressed in dollars and cents than to the fundamental principles underlying rate-making—that is, the basis on which rates should be made. The committee has made a start on its work, and some recommendations will be put into definite shape for consideration at the next meeting. This meeting will last two days and will be held in the office of Mr. Doane, of the National Electric Lamp Association, in Cleveland, on Jan. 4 and 5. The address of the secretary of the committee, Mr. Norton, is 120 West Adams Street, Chicago. Central-station men making a study of the rate question will find the report of the last committee of value. This report is now available in the printed *Proceedings* of the 1911 convention of the N. E. L. A., Vol. I, page 290 and subsequent pages.

Alternating-Current Motor Patent Litigation.

The United States Court of Appeals, sitting at St. Louis, recently handed down an opinion in litigation involving three patents granted to Mr. Ludwig Gutmann on alternating-current motors. The defendant in the suit was the Century Electric Company, which in a lower court had been held to infringe the several patents. The decision on appeal reversed the lower court and ordered that the complainant's bill be dismissed. The patents in the suit were issued respectively Aug. 25, 1891 (No. 458,162), and Dec. 4, 1894 (Nos. 530,176 and 530,177).

The claim involved in the earlier patent was as follows: "In an alternating-current motor, field-magnet coils consisting of such a length of conductor as will produce a counter-pressure or counter electromotive force equal or nearly equal to the pressure in the main line, the brushes of the motor-armature being supposed to be removed."

The court held that this claim merely expresses what was before generally known and practised in the art. "It

was common in motors of various kinds to make the applied and counter potential equal or nearly equal to each other by the method Gutmann pointed out. No particular length of conductor to produce the counter electromotive force was specified by him, and if it had been he could not have patented it because the principle was known and the precise length of coil essential varied with the circumstances, and for any particular machine had to be determined by experimentation. If there was not enough resistance for the voltage sent into the machine the machine would overheat and possibly burn out; if too much resistance, the current could not be forced through. This was primary information when Gutmann entered the field. More than this, Gutmann's device was anticipated in the patent to Stanley, No. 591,301, Oct. 5, 1897, which was applied for Oct. 23, 1888, before Gutmann made application."

After quoting the four claims involved in the second patent at issue, the court stated that these claims contemplate "the production of mechanical motion from electrical energy by a single-phase alternating current in the field magnet inducing polyphase currents in the armature, accomplished by close-circuiting the wound coils on the latter, and —by the fourth claim, but not by the first three—by having the closed windings interconnected, thus producing a continuously progressive shifting of the magnetism in the armature or a rotation of the magnetic poles. It is contended for the patent that Gutmann succeeded in transferring the polyphase or split-phase currents from the field magnet, as in the old motors, to the armature. But we find this same arrangement in the prior patent to Elihu Thomson, No. 407,844, July 30, 1889. This patent describes an alternating electric current motor having a single-phase current in the energizing field and a set of closed coils on an armature inductively related thereto. Thomson points out clearly the polar shifting or rotation and the reason for it, and also says 'the coils on the armature or the closed coils may either be closed singly or together in series or in other ways.' There is in this patent to Thomson everything that is claimed by Gutmann. It is true that the former does not say in so many words, as the fact was, that the currents in his armature were polyphase. Gutmann does, but if the winding of an armature in several closed circuits will produce currents of different phase when in inductive relation to a magnetic field energized by a single-phase alternating current, merely saying so is not new and patentable as against a prior structure similarly arranged."

Taking up the third Gutmann patent, in which only one claim was involved, the court said that, as explained by the drawings and the specifications, this claim relates to "a duplex motor, the rotatable element of which is brought to speed by a single-phase alternating current applied either to the field or armature or both, thereby producing currents of displaced phase which are in turn conducted to a second magnetic field—all for the purpose of providing a self-starting alternating-current motor. Defendant's motor is nothing like this; it is a single-phase alternating motor with one field and one armature. It is contended, however, that the claim is not confined to the precise arrangement set forth in the specifications, which show a second magnetic field. We think that in this particular the claim itself is in harmony with the specifications in that a second field is contemplated; but if this were not so, then in so far as the claim is broader it was anticipated in the prior art. If there are not two magnetic fields in the Gutmann method, as the patent indicates, but only one field twice referred to as performing functions, there is nothing new when compared with a number of prior patents. It will suffice to cite that to Stanley, No. 439,042, Oct. 21, 1890."

In conclusion, the court said that, while there were many claims of anticipation of the three Gutmann patents and quite a number of other defenses, those referred to are sufficient in themselves for the disposition of the case brought before it.

Cost of Street Lighting with Milwaukee's Proposed Municipal Plant.

The Taxpayers' League of Milwaukee calls to the attention of local citizens the increased cost of the public lighting by the new plant which the municipality is arranging to build alongside its garbage-disposal station, compared with the outlay for this service under the present contract with The Milwaukee Electric Railway & Light Company.

The first cost of the proposed plant and equipment for 2000 lamps, the report points out, will be $823,492.73, according to an estimate by R. W. Hunt & Company, to which must be added at least $60,000 for land sites. A bond issue of $250,000 at 4½ per cent and 5 per cent mortgages up to $330,000 have been authorized already, and must be followed by another $330,000 issue of mortgage certificates, making the total interest charges $42,750 a year. Depreciation at 4½ per cent will amount to $36,900 a year. The city plant will pay no taxes, entailing a further loss of $13,200 to the city revenues. Allowing $8,800, or 1 per cent, for contingencies and $71,500 for operating expenses, the total annual cost of the municipal lighting will thus be $173,150, or $86.57 per lamp. This street lighting is now being done by the private company at its contract price of $65 per lamp per year, so that the installation of the new plant will entail an increased cost of $21.56 per lamp, or $43,140 a year.

Edison on the Sherman Anti-Trust Law and Industrial Regulation.

The New York *Evening Sun* of Dec. 12 contains a long interview with Mr. Thomas A. Edison on present and proposed laws relating to trusts and the present industrial situation, in the course of which he stated that he was now engaged on a scientific investigation of the country's industries, with a view to inventing a plan to supplant the Sherman anti-trust law in the regulation of business. He hopes to construct a generic plan or law so designed as to do harm to no enterprise, while benefiting both the business world and the public. The plan, which he says may not take up more than one sheet of 6-in. by 8½-in. notepaper, may then be whipped into shape by trained judicial minds. Asked to speak as to the specific nature of the plan on which he is concentrating his energies, Mr. Edison said:

"I am trying to 'invent' a plan which will be satisfactory to all the commercial bodies in this country—a plan of business that will be practical and work to the benefit of manufacturers and the public. Whether it is possible to invent such a plan I cannot say, because the industrial situation is so complicated. Industries of the United States are so intertwined in their relationships, having so many customs, so many methods of selling and manufacturing, getting their supplies from such a variety of sources, that it seems almost impossible to get a plan or law so broad, so generic, that it will accomplish the desired result. We best see the extent of business complications when we drastically change the tariff. Results are far-reaching and hurt industries which the change is meant to benefit, producing good and bad results in unexpected places."

Mr. Edison is of the opinion that it is utterly impossible for lawyers alone to cope with the present situation. In this connection he said: "A lawyer cannot draw a law covering the complicated conditions of modern industry. He hasn't had the requisite mental experience in the proper field. What is wanted is some person familiar with the selling and buying, the technical as well as the financial end of all industries, to devise some generic scheme that business can work on. It will then be necessary to have the law put into a legal form by the best judicial minds.

"Lawmakers should not have the methods of doing busi-

ness left to them. Such methods should be left to business men. Lawyers should put the methods into legal shape; for business, more and more, is getting into the hands of scientific men as its technical part becomes more interdependent and involved."

Mr. Edison in the interview frequently denounced the present methods of lawmaking. The men who made the present trust law, he said, "didn't know pig-iron from coffins, so far as the producing business is concerned. * * * They sit around a green baize table and frame up a law as a sort of experiment, and instead of conducting all the experiments beforehand they then try it on business while it is still an experiment. Naturally it doesn't work—couldn't work. When it doesn't work they amend it, and after a few years of amendments the thing gets so confused that the makers themselves can hardly in the tangle find the head and tail of the law.* * * They never can adjust the situation without cataclysm. They don't know and haven't the time to learn the technique of business. They have to grind out so much law as a matter of course. * * * Their tried-out law as an experiment does some injury. The flaws are seen but not comprehended. Amendments are made and more injury is done. It is utterly hopeless for them to make a law to control industry that will injure no one. It is a hopeless task for lawyers to try to make such a law unassisted by the industrial experts of the country. No amount of amending the Sherman law can make it right. In this country, with numerous legislatures and a Congress pouring laws out at regular intervals, what chance has business? * * * When two or three men attempt to frame a law or discuss a problem, in an attempt to decide upon executive policy in business or government, there is always considerable difficulty. When five men take up the task difficulties are materially increased. If fifty take up the task it is hopeless. A committee, generally speaking, composed of a large number of men, frames American industrial law. The result is, to say the least, an obscure phenomenon."

Mr. Edison added that he did not underestimate the task before him. He said the task was one of the greatest he had ever tackled—in fact, the problem of the incandescent lamp was nothing beside it.

Referring to the Sherman anti-trust law Mr. Edison said it failed "because it makes everyone in the United States pursuing business do just what he desires not to do. Every man does not want competition. This law compels him to have it."

The attempt, he said, to solve the trust problem by foisting cut-throat competition upon the public, thus leading to the destruction of the weaker, must be given up and some basis of co-operation devised which shall control the power of great corporations to carry out destructive policies, if they have the desire. Amendments to the Sherman law cannot make it practical, for the law is wrong in principle. In inventing a machine, if one has the right principle to start with, the work runs from the complex to the simple, whereas if one has the wrong principle it runs from complex to more complex. Applying this to the Sherman law, he said that no amendments can make it right. The great industrial development in Germany was referred to, and it was stated that, while we suffer from what is variously called depression, industrial unrest and stagnation, Germany marvelously prospers. The reason he ascribes to the fact that Germany has legislated for prosperity, while we, trusting to the inspiration of our legislators and lawyers on subjects with which they are very slightly acquainted, have brought depression upon ourselves.

The remedy, he said, is in a law which shall prevent destructive competition and give every man just as much as he wants and is entitled to in the way of co-operative association; a law which shall permit groups of industries to associate without injury to the public for the purpose of preventing destructive competition; a law which shall prevent the manipulation of prices by the efforts of men except as they can make legitimate use of the law of supply and demand; and he would make it against the law to combine to increase prices, the law to apply not to the corporation, but to the responsible officers of the corporation.

Mr. Edison believes that in the end it will be found essential to legislate to enforce co-operation as against competition. Compelling men to compete when they see that it is to their interest not to do so brings about cut-throat competition, which accomplishes the destruction of the weaker concern and gives the control of the nation's trade to the strong. The inevitable end of such a system would be the real, if not apparent, ownership of the country by a few individuals or giant concerns. A large concern under the leadership of a far-sighted agent of industry or finance can concentrate its attack in some section of the country and by cutting prices destroy its rivals, and, through such victories repeated, the entire trade of the country may be controlled. It is not of much account, he said, to say that some giant corporations are now managed by highly ethical men who would not stoop to a tyrannical use of their power; for if the power for evil remains in existence the corporations will eventually come into the hands of a different kind of men, whose disregard of the precedents set by their predecessors will be disastrous to the consumer.

Mr. Edison would develop co-operation by permitting an association to be formed whereby those included agree with each other, under penalties, not to sell articles below the cost of production, including in that cost depreciation on the plant and legal rate of interest on the investment; the members of the association being prevented from agreeing with each other to raise prices above what would correspond to supply and demand. In this manner the consumer would be protected. All the contracts of such associations should be filed in a bureau open to the public and to the officers of the government, and proper legal means should be given the public and those in the association to enforce through judicial channels of the government the agreements entered into.

European governments, he said, permit the formation of such associations and allow them to set prices if they are not unreasonable. Germany encourages their formation, in order that the producers may obtain fair prices for their goods and "dump" at low prices in all other countries. From Germany's experience, he said, we should learn to form associations whereby none would be compelled to sell below the cost of production. While such associations would protect the small as well as the large producers, it would also give the larger and more cheaply producing concerns a great chance to send goods out of the country for actual cost of production here. This would give more employment to American labor and build up a great foreign trade, while the cost of goods to the American public would be not more than the cost of production plus the legal profit were there no exports.

Closing Sessions of A. S. M. E. Annual Meeting.

The 1911 meeting of the American Society of Mechanical Engineers at New York was brought to a close Dec. 8, after a three days' session, the first meetings of which were reported in the *Electrical World* of last week. On Wednesday evening Dr. Robert S. Woodward, president of the Carnegie Institution of Washington, D. C., gave an address on the subject of "Geo-dynamics, or the Mechanics of the Formation of Worlds." The speaker sketched briefly many interesting figures on the magnitude of this planet, and closed with an account of the planetesimal theory, which is in part succeeding the older nebular hypothesis.

Among the papers read at the professional session of Thursday morning was one by Messrs. G. H. Barrus and C. M. Manly, on the subject of "Variable-Speed Power Transmission." The Manly drive was described, which consists of a pump and one or more fluid-pressure motors, speed control being effected by hydraulic connection between the pump and motors. Tests were carried out by using an electric motor as the driving source, and at speeds of from 105 to 350 r.p.m. the efficiency of transmission averaged 87.7 per cent.

At a parallel session held by the Gas-Power Section Thursday morning Prof. R. H. Fernald, of Cleveland, Ohio, retiring chairman, read an address on "Internal-Combustion Engines," in which he traced the development and described modern types of gas-power units. Mr. H. J. Freyn, of Milwaukee, was elected to succeed Professor Fernald as chairman of the section for the coming year. Messrs. I. E. Moulthrop, of Boston, and Max Rutter were added to the executive committee for five years and one year respectively.

Mr. H. R. Setz, of Warren, Pa., opened the regular program with his paper on "Oil Engines," describing the Diesel or constant-pressure engine and its modifications. Various processes of fuel injection were described, leading up to a description of an experimental engine developed by the author, based on observations of the shortcomings of existing engines. Mr. Setz predicted great commercial possibilities for reliable engines to burn efficiently the heavy oils. As supplementary to his paper he presented figures comparing the cost of gas-producer, natural-gas engine, low-pressure oil engine and Diesel engine plants.

An account of a test of a 85-hp De La Vergne oil engine, by Mr. Forrest M. Towl, was next read in abstract by the secretary. The engine commonly operated an oil pump and was later tested with a prony brake. The total mechanical efficiency was 92.1 per cent and the total station efficiency 25.52 per cent. Prof. W. D. Ennis followed with a mathematical paper on "Design Constants for Small Gasoline Engines."

The morning session was closed with a paper on "Tests, Construction and Working Costs of a 1000-kw Natural-Gas Engine," by Messrs. E. D. Dreyfus and V. J. Holquist. The paper pointed out the care found necessary to obtain dependable test results, the observational errors being minimized to the last degree. The unit tested was located in the Allegheny (Pa.) plant of the American Locomotive Company. Cost of producing energy with the equipment was determined, including all operating expenses and investment charges.

"The Development of the Textile Industries of the United States," a general statement of present conditions, by Mr. Frank W. Reynolds, opened the professional session of Friday morning. Half a million operatives and nearly one billion dollars capital are employed in the combined textile industries of the United States, revolution in the drive of which has recently been worked by the application of motors. Mr. Reynolds' paper referred chiefly to the mechanical and manufacturing problems of mill operation. With mechanical drive, said the author, 72 to 74 per cent of the indicated engine horse-power reaches the machine, with group motor drive 65 to 70 per cent reaches the machine, and with individual motor drive the efficiency is 70 to 75 per cent. The relative economies of motor drive and mechanical drive are still debated questions among mill engineers, although there is no doubt that under conditions such as that of a mill to be driven by water-power inconveniently located electric power cannot be disputed as the best means of drive. The discussion which followed turned on the comparison of isolated and central-station service for mill operation, and it was pointed out that, at all events, the power cost, averaging only 3 to 4 per cent of the total manufacturing cost, may offer slight differences which are insignificant in terms of the much more important considerations of simplicity, convenience, safety and economy of routing work.

Among the entertainment features of the Mechanical Engineers' meeting was a ball Thursday evening, Dec. 7, at the Hotel Astor, and during the days of the convention a number of excursions were made to points of interest about New York, including the Brooklyn Navy Yard, the United States battleship *Delaware*, the White Star liner *Olympic*, the world's largest ship; the J. M. Horton Ice Cream Company, the Hotel Astor power plant, etc.

Variable-Speed Alternating-Current Motors.

The different methods proposed and used for varying the speeds of alternating-current motors were outlined briefly in a paper read by Mr. Gus A. Maier at a meeting of the American Institute of Electrical Engineers held in New York on Dec. 8. In addition to the well-known schemes used with induction motors for varying-speed and adjustable-speed work, the author described numerous types of alternating-current commutator motors employed for this purpose.

Attention was called to the Hunt scheme for obtaining two or three set speeds in a single induction motor by means of internal concatenation. According to one specific arrangement of the Hunt motor, the stator core is provided with an eight-pole primary winding equipped with taps brought out in such places that the winding can act simultaneously as the short-circuited secondary to a four-pole field produced on the rotor secondary. The secondary winding is arranged so that it may be either directly short-circuited on itself or connected to produce the effect of a four-pole winding operating in an eight-pole field. The motor can operate either as an eight-pole squirrel-cage induction motor or in concatenation with a speed corresponding to twelve poles.

The author expressed the opinion that it appears possible to design a cheaper two-speed motor of the Hunt type than one of the ordinary collector-ring type with two primary and two secondary windings. A considerable demand exists at the present time for an adjustable-speed, alternating-current motor, even if it be a little inferior in characteristics to a direct-current motor, in order to overcome the necessity of installing direct-current apparatus rather than alternating-current apparatus merely because a few of the many motors must be of the adjustable-speed type. The author outlined the circuit connections and operating characteristics of the adjustable-speed, single-phase motor of the compensated-repulsion type. As reduced to the two-pole model this motor is provided with four brushes. Two of these brushes act as the transformer secondary to the stationary primary which receives all of the useful power of the machine; the other two brushes act as part of an exciting circuit. When both sets of brushes are short-circuited on themselves the motor operates at practically synchronous speed as though it were a squirrel-cage-type, single-phase induction motor. By introducing into the exciting circuit an emf in time-phase with the supply emf the wattless current in the primary circuit can be adjusted to any required value, either positive or negative, according to the relative polarity of the introduced emf. By introducing into the transformer secondary brush circuit an emf in time-phase with the supply emf the speed can be adjusted to any required value either above or below synchronism.

Following a brief mention of polyphase commutator machines, outlines were given of the Scherbius and the Kraemer systems for obtaining adjustment of speed by combining polyphase commutator and induction motors. The Scherbius system was described in an article by Mr. J. J. Elink Schuurman in our issue dated April 20, 1911. In

the Kraemer system the commutator machine is directly connected to the shaft of the main motor and the energy furnished through the slip-rings of the main motor of the induction type is returned as mechanical energy to the shaft instead of being absorbed in resistance. This system was also mentioned in the article just referred to.

Discussion.

Mr. Harold W. Buck stated that recent developments in arrangements for varying the speed of alternating-current motors, which have not yet become of general knowledge, afford means for applying alternating-current motors for industrial purposes which are almost as flexible as those afforded by the direct-current motors.

In reply to a question by Mr. W. N. Smith relative to the types of variable-speed motors that have been employed satisfactorily on a commercial scale, Mr. Maier stated that the only type used in this country is the multi-speed motor. In Europe the adjustable-speed single-phase and the polyphase commutator motors have been used to some extent.

Mr. Carl J. Fechheimer called attention to the speed-varying system of Heyland, which is somewhat comparable to the systems of Kraemer and Scherbius. A note on this system appeared on page 1201 of our issue dated Nov. 11, 1911.

Mr. B. G. Lamme said that the Kraemer and Scherbius systems, being forms of the so-called cascade system, involve considerable expense and are not satisfactory for wide ranges of speed. He showed that one can readily obtain adjustable-speed characteristics in an alternating-current commutator motor by connecting the armature across one phase and the field circuit across the other phase of a two-phase system.

Dr. C. P. Steinmetz gave an excellent summary of the different types of motors that have been developed for variable-speed work. He remarked that in most of the alternating-current motors the variable speed is obtained by using a commutator, the lack of which on the alternating-current motor has been the basis of its chief claim for superiority over the direct-current motor. An infinite variety of variable-speed motors with commutators have been proposed, but the field for development of a commutatorless, variable-speed, alternating-current motor is still open.

Mr. C. O. Mailloux claimed that the successful operation of single-phase commutator motors in railway service has caused many electrical engineers to revise their opinions of the disadvantages attending the use of commutators, especially in Europe, where most of the development in alternating-current commutator motors has taken place. He expressed the hope that commutation will be brought to as high a state of perfection in connection with alternating-current as with direct-current motors.

Accounts for Telephone Companies in New York.

A uniform system of accounts for telephone corporations has been prescribed by the New York Public Service Commission, Second District. It is to be effective Jan. 1, 1912.

The order of the commission states that during the year 1912 any corporation may, for purposes of comparison, keep on its books, in addition to the accounts prescribed, such portions of its present accounts as may be deemed desirable. For purposes of efficiency of administration and operation any corporation, unless otherwise ordered, may keep temporary or experimental accounts and accounts covering particular divisions of its operations, provided that such accounts shall not impair the integrity of the system prescribed.

It is also ordered that each company be required to keep its accounts and records so that, when requested by the commission, it can show for each exchange system and each toll system in the State the cost of the property devoted to the service of such system and the revenues and expenses of each system. The revenues of an exchange system shall include such proportion of any tolls exacted for the use of toll lines as may be properly credited to the system which originates the toll business. The revenues of a toll system shall include the amount of tolls, after deduction of such proportion as may be properly credited to an exchange system for originating business. The proportion of tolls which shall be credited to an exchange system shall be determined by agreement between the corporations, if the systems are owned separately; if they are owned by one corporation, by resolution of the board of directors, unless otherwise ordered by the commission. The expenses of an exchange system shall include such parts of the operating expenses of toll lines as are not separable from the exchange system, and the expenses of the toll system shall include all operating expenses which are separable from the expenses of exchange systems.

Corporations are divided into three classes: Those having average annual operating revenues exceeding $100,000; those having average annual operating revenues exceeding $25,000 and not more than $100,000, and those having average annual operating revenues of $25,000 or less. The determining amount shall be the average of the annual revenues for three years preceding the date of the order. The classification of operating expense accounts includes a discussion of maintenance expenses, and in this section definitions of ordinary repairs and extraordinary repairs are given and the treatment of depreciation and amortization is described at length.

Decapitalization of Public Utilities.

The City Club of Chicago on Dec. 9 listened to an address by Mr. Delos F. Wilcox, franchise expert of the Public Service Commission for New York City, who spoke on "Decapitalization of Public Utilities." He complimented Chicago on its traction franchises, which are a great advance over previous franchises, but said that even these franchises were open to criticism because they made no provision for paying off and retiring the bonds and other securities of the traction companies during the term of the franchise, so that the city would own the properties at the end of the franchise term and thus be in a position to control its streets. He laid it down as a fundamental principle that the public must have control of its streets and highways, and that ownership is the best control. Operation is another question.

He also criticised the New York Subway franchises as inadequately providing for the future, because they did not require a complete retirement of the indebtedness against the subway construction during the term of the franchise, so that not only would the subways themselves be paid for, but also the equipment. He also criticised them because they made no provision to enforce operation of the extensions and additions which might be built.

He recited two objections urged against the plan of paying for the cost of public utilities out of earnings during the franchise period. The first of these is that capital cannot be found for investment under such conditions. To this objection he took exception and entered a denial. The second objection is that it burdens the present generation for the benefit of the next, as the earnings from service must be made sufficient to retire the securities issued in payment for the construction. He asked, in reply to this objection, what would be thought of a municipality which issued bonds for the construction of pavements or other public improvements and made no provision for retiring these bonds.

Proposed Public-Utility Legislation in California.

A public-utilities bill drafted by a committee of the California Legislature has been presented to that body, which is now in session at Sacramento. At the last public hearing before the committee in San Francisco attorneys of the corporations raised the point that the recently adopted constitutional amendment was in violation of the federal constitution. It was contended that in giving the commission the power to regulate private corporations and not municipally owned utilities the amendment clashed with that section of the federal constitution which guarantees equal protection under the laws.

Sections of the bill were redrawn to meet some objections that had been made. The registration requirement as to stock and bond issues has been omitted from the bill, and a penalty section added, making it a felony, with fine up to $20,000 or imprisonment, for a corporation or any member of it to use money raised by stock or bond issues for any purposes other than those stipulated. The section which required the consent of the commission before any new public-utility enterprises could be launched was amended to exempt wharfingers, warehouse companies, steam and interurban railroad companies, pipe lines and telegraph companies.

A bill introduced in the Assembly provides for the creation of a state water commission to consist of five members, including the Governor, the State Engineer and three members to be named by the Governor for four years and to receive $25 a day for actual service. It is proposed to give the commission control over all waters belonging to the people. The fee for a power permit is fixed at $250, while the fee for other water rights is fixed at $50. After a permit has been granted it is provided that there can be only one investigation by the commission into the merits of the petition. Should any claimant have a grievance he will have the right of appeal to the Superior Court.

Violation of the provisions of the proposed act is made punishable with a fine of not more than $5,000 or imprisonment not exceeding one year, or both. The bill would appropriate $100,000 for the purpose of putting the provisions of the measure into operation.

Public Service Commission News.

NEW YORK COMMISSION.

The Public Service Commission, Second District, will give this week a further hearing upon the application of the Red Hook Light & Power Company, which seeks to exercise franchises granted by the city of Hudson and to enter the field for the furnishing of gas and electricity in that city.

The commission has received a petition for a proposed new electric railway company operating between the cities of Buffalo and Rochester. The proposition involves the consolidation of the Buffalo & Williamsville Electric Railway, the Buffalo & Depew Railway and the Buffalo, Genesee & Rochester Railway, under the name of the Buffalo, Batavia & Rochester Railway Company. The Buffalo & Depew Railway now runs from the city line of Buffalo to the village of Depew, and the Buffalo & Williamsville Railway extends from the city line of Buffalo to the easterly bounds of the village of Williamsville, Erie County. The Buffalo, Batavia & Rochester Electric Railway Company and the Buffalo, Genesee & Rochester Railway Company hold certificates of public convenience and necessity for the building of the railroads between Buffalo and Rochester. The Buffalo, Batavia & Rochester Electric Railway is the owner and possessor of franchises from all the towns and villages through which the proposed line of railway will pass with the exception of the towns of Pembrook and Churchville, which franchises have expired. The proposed route of the Buffalo, Batavia & Rochester Electric Railway will form an extension of the Buffalo & Williamsville Railway, and the proposed route of the Buffalo, Genesee & Rochester Railway will form a continuation of the Buffalo & Depew Railway. These proposed routes join near the village of Batavia and will form one continuous connected line of railway.

The commission is asked to allow the issue of first-mortgage bonds to the amount of $3,000,000, of $1,000,000 preferred stock and of $2,500,000 common stock. It is proposed to convert the stock of the present railway corporations into the stock of the proposed consolidated corporation upon the basis of one share of stock at the par value of $100 in exchange for each $100 of outstanding stock. The petitioners have entered into an agreement with the Batavia & Genesee Construction Company, which, it is stated, is ready to make a contract to build and equip the railway from Buffalo to Rochester, furnish the right-of-way, pay interest on the bonds for a period of two years, the expense of marketing bonds abroad and the engineering cost upon the basis of cost plus 10 per cent profit, and to receive in payment therefor $3,000,000 of bonds at 85 and $1,000,000 of preferred stock at par, the balance to be paid in cash or in the common stock of the railroad company at par.

The petition states that the construction company has already arranged to sell the bonds in London at 85, provided the issue can be made at once. The proposed line of railroad takes it from the connection through Richville, Batavia, Churchville and Gates to a connection with the Rochester Railway tracks in Rochester.

The commission has received an application from the Western Union Telegraph Company for a rehearing upon the order recently made by the commission directing that company to discontinue its practice of charging the Postal Telegraph-Cable Company for certain words inserted on telegrams received from the Postal for further transmission over the lines of the Western Union company. The Western Union company will ask for a modification of the order made so that it will be allowed to charge for the name of the place and the state where the message originated and the word "via," so that three words will be charged for instead of the number of words at present charged for, which is, according to circumstances, four or five. The company was to have been heard at Albany on Thursday, Dec. 14, as to whether or not a rehearing would be granted.

The Central New York Gas & Electric Company has been authorized to exercise rights and privileges under franchises granted by the village of Newark and the town of Manchester. The company is restricted to the exercise of the franchise in the easterly half of the town of Manchester, the remaining part of the town now being occupied by another company. The Central company has been directed to show cause why an order should not be entered requiring it to manufacture, sell and distribute coal gas in the villages of Palmyra, Lyons and Newark, in conformity with the prescribed standards of illuminating power and purity. The company is also required to show cause why it should not make such improvements to its plant and distributing system as will result in improving the conditions under which gas is manufactured and distributed in these villages with proper regard to the pressure at which gas is maintained.

The commission has closed upon its records the complaint of residents of the village of Wilson, Niagara County, against the Conant-Bryant Power Company. The complaint was to the effect that the company had a contract with the village for an all-night service, but that for the last few months the current has been turned off at 2 a. m. Upon the hearing the company agreed to maintain all-night service and the complaint is closed without the necessity of a formal order by the commission.

The Keeseville Electric Company has been authorized to execute a mortgage on its plant and property for $500,000. The company is also authorized to issue $70,000 in twenty-year 6 per cent first-mortgage bonds, $30,000 of which shall be used to take up existing bonds par for par, and $40,000 of which shall be used for the construction of a transmission line to Ausable Forks from Ausable Chasm and local lines at Ausable Forks, and for electric apparatus and improvements to the power house.

The commission has received a petition from the trustees of the village of Cayuga, Cayuga County, asking for a reduction in the price of gas furnished by the Empire Gas & Electric Company. The petition states that the residents of the village of Cayuga should not pay more for gas than the residents of Auburn, as is the case under the present schedule of rates, and asks the commission to fix the maximum price to be charged and also to inspect the meters now used by the gas company to ascertain their accuracy. The complaint has been served upon the company and an answer required within ten days.

The third hearing on the complaint filed by certain organizations of stationary engineers charging that discriminatory rates are given by the New York Edison Company to large customers took place on Monday, Dec. 11, before Commissioner Maltbie, of the commission for the First District. Henry H. Edgerton, of Brooklyn, leader of the complainants, stated that their counsel had been obliged to withdraw from the case owing to pressure of other business, and that he would represent the petitioners before the commission. He presented several computations derived from annual reports of the New York Edison Company to show existence of preferential rates, and these tabulations were attacked by counsel for the central-station company on the ground that the results were based upon assumptions and did not therefore represent actual conditions. The compilations were placed upon the record and the case was adjourned until Dec. 26 at 2:30 p. m.

MASSACHUSETTS COMMISSION.

The Gardner Gas, Fuel & Light Company has petitioned the Gas and Electric Light Commission for authority to issue 822 shares of additional capital stock of the par value of $100 each, and of the aggregate par value of $82,200, for the purpose of raising money to pay outstanding bonded indebtedness and obligations associated with extensions and improvements to the property. The present capitalization of the company is $26,200, par value.

Further action on the location of the proposed tunnel of the Boston & Eastern Electric Railroad under Boston Harbor has been deferred by the Railroad and Boston Transit Commissions, sitting jointly, until the location of the road in East Boston is determined. The company plans to build a double-track tunnel under the easterly side of the business center, providing a route for fast service between the waterfront and Post Office Square, delivering and receiving passengers in the heart of the city as contrasted with the somewhat removed locations of the present steam-railroad terminals. A large station with underground platforms and loop tracks for quick handling of traffic is contemplated for Post Office Square.

NEW JERSEY COMMISSION

During the current week hearings are scheduled by the Board of Public Utility Commissioners of New Jersey for the consideration of information to be submitted by the Public Service Gas Company, to be used in an investigation which the board is conducting into the reasonableness of the charges for service. A petition of the Interstate Telephone & Telegraph Company for approval of an issue of bonds is also to be considered.

The board has ordered street-railway companies to report accidents.

A petition has been filed with the board protesting against the approval of an ordinance passed July 26, 1911, by the township committee of Eatontown, granting a franchise to the New York Telephone Company. The opposition to the approval was withdrawn when the company agreed that, as a condition, it should be stated that nothing in the ordinance should delimit the power of the board to regulate and control overhead construction.

OHIO COMMISSION.

In the case of the Utica Oil & Mineral Company recently the Ohio Public Service Commission indicated that the letter of the new public utilities law will have to be followed in every detail. This company, it seems, had endeavored to secure the approval of a new schedule of tariffs without taking the regular process required by the law. There was no particular objection to the change, as it had been provided for by an ordinance of the village of Utica, but at the same time the commission ruled that strict adherence to the details of the act must be made.

The commission has dismissed the petition of the Kilbourne Mutual Telephone Company to require the Citizens' Telephone Company, the New Ashley Telephone Company and the Sunbury & Galena Telephone Company to make physical connections with it. The commission decided that the Kilbourne Mutual Telephone Company is not operated for profit, and is therefore not entitled to such connections. If these small companies desire the advantage of connection with the larger systems it will be necessary for them under this decision to reorganize under the laws providing for incorporations for profit.

Because the ordinance had been enacted some time before the utilities law had become effective, the petition of the Bucyrus Light & Power Company for relief from excessively low rates was dismissed. The commission in this case recognized the principle applying to retroactive laws.

MARYLAND COMMISSION.

The Maryland Public Service Commission will take up for action the complaint of the Mayor and City Council of Baltimore and of the Park Approach and other associations against the Consolidated Gas, Electric Light & Power Company concerning rates charged by that company for gas and electricity, as soon as it disposes of the telephone case on which it is now engaged. A number of conferences have been held between the engineer of the commission, Mr. Charles E. Phelps, and the officers and engineers of the Consolidated company. Mr. Phelps is now at work on the voluminous reports of the affairs of the company which were submitted some time ago. They are exceedingly complicated, and it will be several weeks before he will complete his analysis of them and submit his findings to the commission. In the meantime a supplemental report will be received from the company showing the company's estimate of the value of its "intangible assets." It did not have this report ready when it submitted its other reports, and, although not expressly called for by the commission, the company asked permission to submit it, which permission was granted. It is probable that before the hearings on the gas and electric question begin experts will be called in from other cities to assist the commission's engineer to check up the figures and to aid the commission in determining what would be a fair price for the company to charge for gas and electricity on the basis of the present investment and the value of its property.

Orders have been passed from time to time affecting the Easton Fuel & Light Company, but Mayor Higgins of Easton and several others have complained that the company has paid no attention to them. Albert C. Ritchie, assistant general counsel, notified the commission that the law provides for a fine of $1,000 for each distinct violation of the orders of the commission, and that this penalty may be enforced against the corporation itself or against such of its officers or employees as have knowingly failed or neglected to comply with the commission's orders. The

commission directed him at once to take such steps as he thought proper to see that the orders of the commission are complied with.

On Dec. 13 the commission will take up a matter in controversy between the Paper Mills Company and the Consolidated company as to a flat rate for electricity. The Paper Mills Company asserts that the Consolidated guaranteed that its bills for electric power would not amount to more than $100 a month, and when they ran over the company refused to pay the excess over $100. The central-station company maintains that under the provisions of the law it cannot give a flat rate and that fixing a maximum charge of $100 a month would be giving such a rate.

The Southern Maryland Railroad, now extending from Brandywine, in Prince George's County, to Mechanicsville, in St. Mary's, some time ago projected an extension from a point near Washington to Point Lookout, with a terminal and pier at Esperanza, in St. Mary's County. Last June the company applied to the Public Service Commission for authority to issue $2,000,000 in bonds and $1,500,000 additional stock, bringing its stock issue up to $2,000,000. The bonds were to be issued at 80 and the stock at 33⅓, Mr. Frank B. Jones, of Philadelphia, having filed an affidavit with the commission asserting that the bonds and stock could be sold at the prices mentioned. A day was appointed for a hearing, but the promoters of the proposition did not appear before the commission and no action was taken. It is asserted that the company will now issue the $2,000,000 of bonds originally asked for but without issuing the additional $1,500,000 of stock, and it seems that under the law the Public Service Commission cannot prevent this. This raises an issue that may result in legislation at Annapolis next winter.

A complaint has been filed with the commission by a number of newspaper correspondents of Denton, who allege that they are unable to secure a service by which news matter may be rushed to the newspapers of Baltimore and Philadelphia. The several correspondents claim that the telegraph facilities are such that news matter must come to Baltimore by a roundabout route. To secure better service the correspondents claim that an additional wire should be strung by the telegraph company. The limited telegraphic facilities are said to exist in other towns along the Eastern Shore, where the telegraph offices close early and where railroad orders over the line often delay private messages which have been filed previously.

WISCONSIN COMMISSION.

The commission has authorized the Berlin Public Service Company to issue $70,000 par value of 5 per cent bonds, to be issued and exchanged on the basis of 85.4 per cent of par value for the plant, property and effects, both tangible and intangible, of the Berlin Gas Company. The mortgage deed is made out to the Fidelity Trust Company of Milwaukee as trustee. The value of the property, according to the commission's tentative valuation, is $60,000.

An order has recently been issued by the commission which, while affecting directly the Merrill Railway & Light Company, is to be enforced in all cases where electrolytic meters are in use. The order consists of a new set of instructions, rules and regulations concerning the manner in which electrolytic meters, especially of the Bastian type, are to be tested, inspected and calibrated in order that the present rules of the commission fixing the maximum variation in accuracy as 4 per cent may be rigorously applied to electrolytic meters. When the original rules for meter service were drafted the commission had in mind meters of the motor or induction type only, and consequently the present rules for service do not include electrolytic meters. The order was issued after a joint conference between the engineering staff of the commission and the manufacturers and central-station managers concerned.

The commission has rendered its decision in the case of the La Crosse Gas & Electric Company. The petition in the matter was filed with the commission Aug. 19, 1910, by the La Crosse Gas & Electric Company, and in it authority was requested to substitute for the rates now in effect for gas, electric and heating service other rates which were in certain respects increases over rates now existing. This application was made following a period of operation under a previous provisional order of the commission affecting the petitioner's rates then in force.

During the portion of this period prior to the company's receipt of an indeterminate permit the rates as authorized by the commission were so limited by a franchise agreement that the maximum rate which the petitioner received for electric service was 10 cents per kw-hour and $1 per 1000 cu. ft. for gas. The company contended that its earnings were not sufficient and based its claim upon a valuation which it held should be the basis upon which it should be allowed to earn interest. The company's book value of date June 30, 1909, was $1,290,530, which was increased to $1,827,000 during the period to June 30, 1910. The total reproductive value was estimated by the commission as $963,086. The present value of the physical property, as determined by appraisal and subsequent adjustments made necessary by facts revealed in the testimony and by investigation, was $719,740, and the cost of reproduction $921,337. The original cost of the property and the cost of subsequent extensions could not be accurately determined, for the records bearing on these matters offered little explanation of the original transactions. The present organization of the company is one that secured, through purchase, properties that had already been in operation for a considerable time, and it had added to these properties not only extensions made by itself, but other constructions built by other concerns for competitive purposes.

The difference between the company's alleged valuation and the valuation as made by the commission is due to several causes. The petitioner included the total cost of equipment, a considerable portion of which was duplicated when the various properties were acquired and was deducted by the commission as property not used or useful. The commission limited the cost of pavement to the actual cost incurred in cutting through it, and refused to accept the petitioner's contention that the total cost of $82,000 should be included in determining the reproductive value. Believing the company to be evidently overcapitalized, the commission was not inclined to accept the face values of the various securities purported to have been given in exchange for the different properties as evidence of the actual value involved. Although the petitioner testified that it was entitled to a certain sum as "going value" in virtue of the commission's policy in such matters, no reliable value could be determined upon because of the meager information at hand.

It was the opinion of the commission, though, that the earnings had been high enough throughout a period of years, with the possible exception of the time when vigorous competition existed, to make up for the early losses incurred in building up the business. Concerning these losses and the trouble which the utility has had for some time with its patrons, the commission comments as follows: "What consideration should be given to losses that may be the result of competition occurring some years after the first construction is a matter that is not clear. One view that may be held is that during periods when no public regulation of utilities exists and there is little restriction as to the number of concerns that may enter the same field the risks of the business are greater and the utilities are therefore entitled to larger returns during the profitable years than would otherwise be the case. Investors, it may be held, knowing as they should that these conditions prevail, take upon themselves, when entering the field, the risks of the business as well as the profits. Another view may be advanced holding that since a municipality during former years could

choose between allowing one or more utilities of the same kind to supply the community, it took upon itself the responsibility of increased costs and losses due to competition when duplicate franchises were granted. It seems quite certain that municipalities are to some degree responsible for the increased cost of service and losses in conducting the business when they permit duplicate investment to serve an already adequately supplied public. Just how the public in such instances expects to profit permanently by such action is difficult to say. As a rule its action is believed to be due to a misapprehension as to the cost of service, the amount of profit utilities usually earn and the rights to which they are entitled. High rates, poor service or other local circumstances have sometimes formed the grounds upon which attack or retaliation has been made by the public by permitting competition to take place; to what extent it was justified therein, in the absence of other protective methods, depends largely upon the importance of these offenses and whether the utility was responsible for them." While not committing itself, the commission evidently did not consider the La Crosse Gas & Electric Company the greatest offender.

From an examination of the available facts, the annual operating revenues and expenses, additions to the property and their relation to the present cost of reproducing the physical property, the commission held that the amount upon which the company was entitled to earn interest was not far from the cost of reproduction. The rates for gas service and for heating service were not changed, although the commission recommended that the form of the schedules be altered to conform more nearly with the respective cost curves. The minimum bill for electric lighting was increased from 75 cents to $1.

The present rates for electric lighting consist of a service charge of $1.80 per year per 16-cp lamp or equivalent demand, with one-third the connected load considered active, and a meter rate of 7.5 cents per kw-hour for a monthly consumption equal to or less than sixty hours per month, with an excess rate of 6 cents. This schedule was not altered for residence lighting, but for business lighting the commission ordered the percentage of active connected load increased from 33 to 38. No change was made in the rates for electric power because none was applied for, but an analysis of revenues and expenses showed that the company's power business is far from remunerative. The present output charge is 2 cents per kw-hour, whereas the output cost, according to the commission, is 3 cents per kw-hour. The company's relatively large power business is due not so much to the need of electric power as to the inducements in the shape of attractive rates which were offered during the time when competition was keen.

CURRENT NEWS AND NOTES.

LABORATORY EXPERIMENTS FOR NEW YORK EDISON EMPLOYEES.—Nearly 200 employees of the New York Edison Company are availing themselves of the laboratory practice courses offered by the company. There are 126 taking the elementary course, thirty-six in the direct-current course, and thirty in the alternating-current course. Employees engaged on night work have the use of the laboratory each Tuesday afternoon from 1 to 4 o'clock.

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RESIDENCE-BUSINESS N. E. L. A. COMMITTEE.—A meeting of the residence-business committee of the Commercial Section, National Electric Light Association, was recently held at the office of the chairman to organize and discuss plans for the year's work. Those composing the committee are Messrs. J. F. Becker, New York City, chairman; N. H. Boynton, Cleveland, secretary; S. M. Kennedy, Los Angeles, Cal.; G. B. Griffin, East Pittsburgh, Pa.; F. H. Gale, Schenectady, N. Y.; E. A. Norman, New York City; G. C. Osborne, Harrison, N. J., and F. D. Pembleton, Jersey City, N. J.

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MUNICIPAL RESPONSIBILITY IN GRANTING COMPETITIVE FRANCHISES.—In a recent decision by the Wisconsin Public Service Commission on a petition for higher rates by the La Crosse Gas & Electric Company there is an interesting discussion by the commission of the principle of granting competitive franchises, which practice is, by implication, condemned. An abstract of the decision is given elsewhere under the head of "Public Service Commission News."

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NELA ENGINEERING SOCIETY.—An organization to be known as the Nela Engineering Society has recently been formed by the members of the engineering department of the National Electric Lamp Association, Cleveland. The society will be a forum for papers and discussions on subjects of general engineering interest presented by members of the society and by outside speakers. Twenty-five persons were present at the organization of the society, which will meet every Thursday evening. Mr. M. D. Cooper was elected president.

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PROPOSED KENTUCKY PUBLIC UTILITY COMMISSION.—A movement is under way to secure legislation in Kentucky for a commission of public utilities. It is said that the first definite action toward the institution of such a body will be taken in a strong recommendation along this line by Governor James B. McCreary in his first message to the State Legislature in January. The work of the State relative to the regulation and enfranchisement of public-utility corporations is at present performed by the auditor of public accounts, the state treasurer and the secretary of state acting as a special committee. It has become too onerous, however, and it is proposed to establish a special commission, modeled along the lines of the state railroad commission, to handle the questions which arise in the regulation, taxation and adjustment of difficulties with telephone companies, electric companies and other public-service bodies.

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BOSTON SUBWAY LEASES SIGNED.—Leases covering the use of all subways and tunnels for electric railway service now existing in Boston were signed on Dec. 7 by President William A. Bancroft, of the Boston Elevated Railway Company, and by members of the Boston Transit Commission for the city of Boston. The leases also covered the use of the proposed Dorchester tunnel, Boylston Street subway, East Boston tunnel extension and the Cambridge connecting tunnel, as well as the Tremont Street subway and the East Boston and Washington Street tunnels now in operation. By the terms of the instruments, which are seven in number and which cover sixty-nine pages of printed matter when bound in a single volume, all the foregoing subways and tunnels are leased until 1936. At that time the termination is conditioned upon a two years' notice by either party. The rental to be paid by the company in every case is 4½ per cent of the net cost of construction, payable quarterly. After June 10, 1922, the company will be discharged from the obligation of collecting tolls for the city in its use of the East Boston tunnel. The leases were signed as a result of the agreement of the parties following an act of the last Legislature. Unless a pending suit by minority interests of the West End Street Railway Company to determine the constitutionality of the act authorizing the consolidation of the West End and Boston Elevated companies results in a finding against the act, there is nothing further to prevent the construction of the new tunnels and subways above mentioned by the Boston Transit Commission.

City Electrician Free of Political Influence.—By a provision of the new charter of Pueblo, Col., applying to the commission form of government, the position of city electrician is made permanent, except for cause. This is the second city of the Rocky Mountain regions to take inspection work out of politics, and as both Colorado Springs and Pueblo have unusually efficient electricians the progress toward permanency and safety in all new construction is very rapid.

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A Fireproof Coal Pile.—Two central-station men were discussing the fuel value, or rather the lack of it, in a certain coal which one had been trying under his boilers. "On the day of judgment," he finally remarked to the other in accents of conviction, "when the fire-bells begin to ring and the whole world lights up with red flames, according to prophecy, you can just watch me scramble up on to that pile of Rhode Island coal, for I know that will be the last thing on earth to burn!"

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Missionary Work by Wireless Telegraphy.—In a recent address at Northampton, Mass., Dr. Wilfred T. Grenfell, the well-known Labrador medical missionary, emphasized the value of wireless telegraphy as a means of communicating instructions from the hospital boat to persons ill or suffering from accidents at sea who are beyond the reach of contact treatment. Dr. Grenfell intimated that by this method the sphere of usefulness of the Labrador Deep-Sea Mission has been greatly increased within the past few years.

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Boston Electric Vehicle Club Banquet.—Invitations are being mailed for a banquet to be given by the Electric Vehicle Club of Boston at the Boston City Club on Dec. 19 at 6 p. m. The speaker of the evening will be Mr. Hayden Eames, of Cleveland, Ohio, his subject being "The Motor Vehicle for City and State." A representative attendance of prominent city and state officials is expected, and a special effort will be made to bring home in a new and striking manner the fitness of electric pleasure and commercial vehicles for service in large cities.

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Wireless Regulation.—The case of the United States against the steamer *Templemore*, of the Johnson line, charged with the violation of the new federal wireless law, is now pending in the United States District Court of Baltimore. The *Templemore* took a large number of Republican politicians across to England and Ireland some months ago and was not provided with wireless apparatus. The law says that any steamer carrying more than fifty passengers and sailing more than 200 miles from the coast shall be provided with a wireless outfit. One of the points which the defense is expected to raise is that the politicians were not passengers at all, but were members of the crew, with special duties. One of them, for instance, was the official rocket-shooter. He fired one rocket during the trip, it is declared, this being off the Irish coast. United States District Attorney John Philip Hill, with one of his assistants, will conduct the case for the government. Special interest attaches to this trial, as it is the first prosecution under the new law.

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Electrical League of Cleveland.—The Electrical League of Cleveland held its third annual meeting and smoker at the Moose Club Hall on Thursday evening, Dec. 7. The earlier part of the evening was devoted to the election of officers for the coming year, as follows: Mr. David Aitken, president; Mr. J. Robert Crouse, first vice-president; Mr. L. Greisser, second vice-president; Mr. N. C. Cotabish, third vice-president; Mr. Peter Yensen, fourth vice-president; Mr. T. P. Cagwin, secretary; Messrs. H. H. Cudmore, A. L. Oppenheimer, G. C. Webster and C. T. McKinstry, executive board. A large delegation from the Electrical Boosters' Club of Pittsburgh was cordially welcomed by the members of the Cleveland League. Among the speakers of the evening who made brief addresses were Mr. A. A. Gray, of Chicago; Mr. Harris and Mr. Harrison, of Pittsburgh, and Mr. J. Robert Crouse. The entertainment features consisted of orchestra, glee club and mandolin music, vaudeville productions, boxing exhibitions, plenty of good cigars and an ample Dutch lunch. The smoker was characterized by a feeling of good fellowship and informality on the part of all present.

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Scholarships for Throop Polytechnic Institute.—A friend of Throop Polytechnic Institute, of Pasadena, Cal., has established two scholarship awards to be known as the senior and freshman scholarship prizes respectively. The former consists in ample provision for a trip to Europe, and will be awarded on each commencement day to that member of the graduating class who has the best record in scholarship for the junior and senior years, the faculty taking also into account in assigning the award considerations of deportment or good manners and ability for original work. This prize is $750 cash. The freshman scholarship prize consists in full provision for a journey through some of the principal cities of the Eastern United States over a route recommended by the faculty, and will be awarded on each commencement day to that member of the freshman class who has the best scholarship record for the year, good manners and the quality of initiative being also taken into account. This prize is $250 cash. The faculty may in some instances permit this prize to be used for other purposes than travel, but reserves the right to indicate the mode of its use in case of any such exception.

* * *

Snowstorms and the Commercial Motor Wagon.—What leading merchants think of mechanical transportation is revealed in large display announcements that have appeared recently in daily and Sunday newspapers. In New York, for example, following the snowstorm of Monday, Dec. 4, John Wanamaker ran a 324-line advertisement headed "The Delivery System That Stood the Test of the First Blizzard." In this announcement the store called attention to the fact that in the face of the storm all deliveries went out on schedule from its distributing stations to such remote points as Stamford, Conn.; Greenpoint, L. I.; Plainfield, Morristown and Englewood, N. J. This extraordinary feat was accomplished with a fleet of fifty-eight motor vehicles, including ten large trucks that carried the packages in bulk to the suburban stations, whence they were distributed. Gimbel Brothers used one-third of their advertising space in Thursday's papers to announce that, so far as they know, their New York store is the only big store in the world that delivers its goods exclusively by motor vehicles, and that "no blizzard can stop Santa Claus when he starts from Gimbel's." The announcement stated that the delivery equipment includes seventy-five electric wagons, thirty gasoline wagons and thirty gasoline and electric trucks. With the opening of its large new department store in New York, Kesner's announced in a large display "Our specialty is service," and made the promise that its up-to-date motor delivery service would take care of every order promptly even if the second day should prove bigger than the opening day. Regarding the reliability of the motor truck for delivery work, Stanley Field, of Marshall Field & Company, in Chicago, said recently: "All the year around, winter and summer, the truck bucks the road and carries our goods into far and out-of-the-way places. It would be impossible to ship to these places by horses. We used to try, but the labor was too wearing on the animals and there was a loss with each journey. So we gave it up and used the railroad until the motor truck came."

ELECTRIFICATION OF A LOUISIANA RAILROAD.—It is announced that the Louisiana Southern Railroad, which with an extension now under construction will be 75 miles long, will be electrically operated. The road extends from New Orleans and serves a populous district.

* * *

ELECTRIC HOLIDAY CELEBRATION IN MUNCIE, IND.—The business men of Muncie (Ind.) have contributed a substantial sum to be used for an "electric holiday celebration." Special decorative street lighting will be erected along twenty-two blocks of city streets, and other electrical attractions will add to the effectiveness of the display.

* * *

CENTRAL-STATION LUNCHEON TO EMPLOYEES.—A luncheon was given last week by the Consolidated Gas, Electric Light & Power Company, of Baltimore, to the employees of its electric division at 30 South Eutaw Street, one of the company's buildings. Upward of 600 men were present. The purpose of the meeting was to afford an opportunity for the employees of the company to become better acquainted. There were informal talks by Mr. Herbert A. Wagner, vice-president of the company; Mr. Douglass Burnett, commercial manager of the electric division, and Mr. R. H. Tillman, industrial power engineer. A buffet supper was served and an orchestra played.

* * *

TABLES OF SCIENTIFIC DATA.—The first volume of the "Annual Tables of Constants and Numerical Data: Chemical, Physical and Technological," compiled and published by an international commission appointed by the Seventh International Congress of Applied Chemistry, is now open to subscription. Subscription blanks, the terms of subscription and descriptive leaflets may be obtained from any one of the three American commissioners—Dr. G. N. Lewis, Massachusetts Institute of Technology, Boston, Mass.; Prof. G. F. Hull, Dartmouth College, Hanover, N. H., and Prof. J. Stieglitz, University of Chicago, Chicago, Ill. After Jan. 15, 1912, the price of the volume is likely to be increased.

* * *

CENTRAL-STATION MEN AS FIRE FIGHTERS.—A correspondent calls attention to the omission from the abstract in our issue of Nov. 4 of the report of the investigation of fire in the generating station of the St. Croix Power Company at Apple River Falls, Wis., of that part relating to the rôle played in saving the station by the superintendent and station employees of the St. Croix company. He adds that there is no record of a finer piece of work, considering the extinguishing agents available, performed even by men trained in the art of fighting fires. "Not one crew in a thousand would have successfully carried out, or even seriously attempted, the work of extinguishing a fire located out of reach and of the proportions the one in question had gained when discovered. The successful accomplishment of this huge task should be an encouragement to other station men when confronted by a similar problem. There are thousands of power houses as inadequately protected from fire dangers as the one at Apple River Falls, and power-house owners should appreciate the importance of selecting intelligent men as operatives and of bringing about suitable recognition of the services of these operatives when a duty has been faithfully and intelligently performed."

* * *

OVER 10,000 N. E. L. A. MEMBERS.—At the meeting of the executive committee of the National Electric Light Association on Dec. 7 it was announced that the membership had reached 10,000 and was, in fact, very nearly 10,150. The news was received with much pleasure by the officers as indicating how rapidly the body is moving forward in execution of its program for the complete organization of the industry. Up to July, 1909, the membership of the association was still below 3000, but the last two years have been periods of unprecedented expansion, and there are many indications that the end is by no means yet. In his presidential address this year Mr. Freeman estimated that a few years hence the association might well have a membership of 25,000, while Mr. Samuel Insull, with wonted boldness, ventured upon the prediction that in view of the tremendous strides the central-station industry was making, the membership should within a period of perhaps ten years attain a figure of not less than 40,000. The official headquarters in the Engineering Societies Building are undergoing corresponding expansion, four additional rooms having been taken within the past three months, so that the space occupied by the association is virtually as great as that occupied by any one of the three founder societies.

* * *

ELECTRIC LIGHT POLARITY.—In a broadsheet sent out by the "Cross Publishing House," Nuevitas, Cuba, as one of a series expounding "The Gospel That Blesses All the Families of the Earth," the writer employs an electrical analogy to support a conclusion that "In the autumn of 1912 shall begin to be visited the antitype of the slaying of the firstborn." The title of the tract is "Concerning the Laws That Govern All Things," and it opens with an account of the electrician turning on the current, and how the light "unostentatiously and noiselessly crept into the bulbs and chased away the darkness." But, it is added, if "you follow the wires down to the power house, and as the whir and grinding of the high-speeded machinery strike upon your ear you begin to think that, after all, it takes a great deal of noise and friction to produce the velvety-slippered light, the electrician will tell you that there are two poles to this subtle light-current, positive and negative. He will tell you that the first-mentioned pole is the superior, is energizing and sweet, and that the negative is secondary, enervating and acid. If you should ask him which pole goes to the upper carbon of the scintillating arc light, he would inform you that it must be the positive, and that the negative must go below." The writer then proceeds to discuss whether "knowledge, as in the case of the light, is also produced by a terrible grinding and friction, and has what correspond to the positive and negative poles of the electric current."

* * *

LARGE CENTRAL-STATION STORAGE-BATTERY PLANT.—The installation of a storage battery weighing more than 600 tons and said to be the largest in the world was completed last week at the McClellan Alley substation of the Consolidated Gas, Electric Light & Power Company of Baltimore. This battery plant will eliminate the inconvenience of shutdowns, such as followed an accident some time ago at the McCall's Ferry station, when the whole lighting and power service throughout the city of Baltimore was discontinued for about six minutes. At the formal opening of the plant a buffet luncheon was given by officials of the electric company to several hundred guests. The Consolidated Gas, Electric Light & Power Company has an ample power supply for years to come from the large generating stations at Westport and McCall's Ferry, either of which alone is now perfectly capable of handling the city's need and both of which are kept in operation day and night. The battery, while constantly connected with the lines of the company, will not come into play unless both of the generating stations are disabled at the same time, when it will automatically pick up the "load" and sustain it without interruption to the service. The battery cost over $400,000, including installation, and it took fifty-one freight cars to transport the parts from Philadelphia to Baltimore. There are 20,216 lead plates weighing 303 tons contained in tanks weighing 72 tons, while 138 tons of acid, 18 tons of glass plate, 6 tons of switches and 9 tons of porcelain insulators were used. Other equipment includes heavy switchboards, 14 tons of copper connections and the charging machinery.

Electric Vehicle Association of America.—At the meeting of the Electric Vehicle Association of America to be held in the Engineering Societies Building, New York, Dec. 19, Mr. S. G. Thompson, of the Public Service Electric Company, Newark, N. J., will present a paper entitled "Is Central-Station Activity Justified in the Electric-Vehicle Field?"

* * *

Jovian Theater Party in Philadelphia.—The Philadelphia Section of the Sons of Jove gave a theater party on the evening of Dec. 8. About 700 Jovians, with their wives and sweethearts, attended the Chestnut Street Opera House to witness the performance of Miss Lula Glaser in her latest success, "Miss Dudelsack." Quite a number of the New York Jovians journeyed to Philadelphia on this occasion, and the theater was appropriately decorated. After the theater an adjournment was made to the Bingham House for supper, during which speeches, songs, etc., were in order. The success of the entire undertaking was mainly due to Mr. Washington Devereux, and is in line with several features that he has inaugurated in Philadelphia in order to create and maintain an interest in the Sons of Jove.

* * *

New York Companies' N. E. L. A. Section.—The New York Companies' Section of the National Electric Light Association will hold its tenth regular meeting on Monday evening, Dec. 18, in the Edison Auditorium, 44 West Twenty-seventh Street. At the meeting Mr. Frederick Kurz, of the New York Telephone Company, will deliver an illustrated lecture on "The Telephone Girl," and Mr. M. S. Seelman, Jr., advertising manager of the Edison Electric Illuminating Company of Brooklyn, will speak on the subject "How to Promote Company Sections." The paper presented by Mr. George A. Saunders, of the Westchester Lighting Company, at the last meeting of the section on the "Relation of the Employee to the Employer and to the Public" will be discussed. The usual entertainment and refreshments will be provided by the entertainment committee.

* * *

Cahill Electrical Music at a New York Banquet.—During a banquet given last week at the Hotel Astor by the "Athletics" baseball club to the Baseball Writers' Association of America the New York Cahill Telharmonic Company provided entertainment in the form of music produced on the improved telharmonium, now called the "electrophone." This instrument, which is located at 535 West Fifty-sixth Street, was operated by two musicians who were in constant telephonic communication with the musical director at the Hotel Astor, 2 miles distant, as measured over the electrophonic circuits. So intimate was the intercommunication that the electrophone was used to accompany a soloist at the banquet. The electrophonic entertainment, which was highly successful, represented the first public performance of the improved instrument, which was described in our issue dated April 28, 1910.

* * *

The Panama Trip of the Institute.—Mr. S. D. Sprong, chairman of the committee on the Panama trip of the American Institute of Electrical Engineers, announces that it has been decided definitely that the trip to the Isthmus of Panama shall be undertaken. The New York party will leave that city on Jan. 17, at noon, arriving at Colon on Jan. 25 and returning to New York on Feb. 8. The New Orleans party is scheduled to leave that city on Jan. 20, at 11 a. m., arriving at Colon on Jan. 25 and returning to New Orleans on Feb. 6. The rates for the New York trip range from $125 to $210.50 and for the New Orleans party from $95 to $142.50. This includes meals and berth on shipboard, but not accommodations at Panama. Remittances for accommodations should be made payable to Mr. F. L. Hutchinson, acting secretary of the Institute, 29 West Thirty-ninth Street, New York.

* * *

Western Association of Electrical Inspectors.—The seventh annual meeting of the Western Association of Electrical Inspectors will be held Jan. 23, 1912, at the Plankington House, Milwaukee, Wis. The meetings will include an experience session, and reports of committees will be presented on grounding secondaries, public safety, theater wiring, show-window and display wiring, and pole-line construction. Among the papers will be one by Mr. W. J. Canada on "Grounding of Conductors and Conduit"; one by Mr. W. G. Middleton on "Electrolysis," and one by Mr. H. B. Long on "Lightning Protection of Buildings." Meetings were formerly held in October, but are to be in January in future to avoid conflict with other conventions and meetings. A special car will run out of Chicago to Milwaukee on Jan. 22 at 6:30 p. m. on the Chicago, Milwaukee & St. Paul, to accommodate delegates. Mr. W. S. Boyd, 76 West Monroe Street, Chicago, is secretary.

* * *

Concrete Work on Keokuk Dam to Proceed Throughout Winter.—The work of placing concrete on the great water-power dam and generating plant in the Mississippi River at Keokuk, Ia., will go on uninterrupted during the winter months. Machinery has been housed, water pipes have been covered, and arrangements have been made for heating the sand and water used in the concrete mixture. The power house and locks on the Iowa side, as already explained, are being constructed behind the protection afforded by a cofferdam wall. In spite of the unusual flood height of the river this fall, no delay has been experienced from this cofferdam. Work on the dam proper, stretching out from the Illinois side, has, however, been temporarily interrupted by high water; but, as this construction will take less time to complete than that of the power house and locks, the final date of completion will not be affected. Up to Oct. 17, when water overflowed the Illinois cofferdam, 69 of the 119 arches had been completed, the glistening white line of the 36-ft. concrete arches now extending more than half-way across the bed of the river.

* * *

National District Heating Association.—As previously reported in these columns, the coming annual convention of the National District Heating Association will be held in Detroit, Mich., on June 25-27, 1912. The program for the convention will include papers on the following subjects: Depreciation in underground distribution systems; operation of turbines and reciprocating engines in connection with steam-heating work; combined steam-heating, ice-making and electric-power system; radiation tests; heat losses in steam distributing systems; a large hot-water-heating system; quality of steam supply as affected by superheating; decentralized heating plants; relative economies of the one-pipe and two-pipe heating systems; common sources of trouble in customers' installations; thermodynamic economy of combined power and heating systems; different systems of underground construction. The headquarters of the convention will be at the Cadillac Hotel. The accompanying manufacturers' exhibition will be in charge of the association. The membership of the association has increased from 32, two years ago, to 182, and an effort is being made to reach the 250 mark within the next six months. Mr. D. L. Gaskill, Greenville, Ohio, is secretary.

DELRAY STATION OF DETROIT EDISON COMPANY.

Plant Includes Largest Boilers Yet Made, Capable of Supplying Turbine Loads Up to 11,000 kw.

High Economies in Steam Generation—Combined Hot-Well and Boiler-Feed Pumps—Special Steam Valves—Ventilation of 14,000-kw Turbo-Generators from Engine-Room—Combination of Oil and Water Step-Bearing Pressure Systems—Stations Designed for Continuous-Load and Peak-Load Operation.

FOUR miles southwest of the business center of Detroit, on the shore of the splendid river connecting Lakes St. Clair and Erie—a stream which, by the way, carries the largest tonnage of water-borne traffic in the world—are located the great Delray power houses of the Detroit Edison Company, now totaling 75,000 kw in maximum turbine rating. Besides the unusual, distant location of this plant as originally dictated by the expected sale of exhaust steam to salt mines near by, the Delray stations embody many interesting and novel departures from ordinary plant practice, the most remarkable of which is the pioneer use here of huge nominal-2365-hp boiler units, from which steam demands as high as 11,000 kw per boiler have been taken. The extraordinary efficiencies shown by these great boilers in performance and test make it probable that the way thus blazed by the Detroit company will be the future line of plant development elsewhere, bringing the belated progress of boiler sizes more nearly abreast with the steam units of to-day.

Fig. 1—Generating Station of Detroit Edison Company at Delray, Showing Coal-Storage Yards.

THE TWIN STATIONS AND THEIR OUTPUT.

The Delray plant at present comprises the No. 1 station, built in 1904 and now containing two 9000-kw and three 3000-kw turbo-generators, and the newer No. 2 station, completed in 1908 and designed for four 14,000-kw turbines, three of which are already in service. The boiler-room containing the huge 2365-hp boiler units forms part of the No. 2 plant.

The principal output of the Delray plant is served to the customers of the Edison Illuminating Company in Detroit, including a large connected industrial motor load. The station also supplies the suburban district of the Eastern Michigan Edison Company which centers about Detroit within a radius of 30 miles, with one 50-mile transmission to Memphis, Mich. About one-fifth of the total generated output of the Detroit central-station system is absorbed by the Detroit United Railways to operate their street cars in outlying districts of the city. The electrified Detroit River tunnel of the Michigan Central Railroad is also operated by central-station energy from the plant to be described.

Under the present conditions of operation the No. 1 station is essentially the continuous-load plant, showing a nearly flat economy curve over a wide range of loading. The boilers in this section are to this end equipped with economizers to further its high-efficiency performance under various loads. The No. 2 plant with its 14,000-kw turbines and large boilers is, on the other hand, the peak-load station and is operated at its maximum capacity only during the hours of heaviest demand. The 14,000-kw turbines show their highest efficiency in the region of 8000-kw load, decreasing slightly with accession of load up to their maximum rating. A similar economy relation is shown by the big boilers, as the accompanying efficiency curve (Fig. 8) illustrates. These huge boiler units have their highest efficiency at about their rated load on a basis of 10 sq. ft. per hp, falling off about 5 per cent in economy at 210 per cent load.

ERECTION OF FIRST PLANT, WITH 511-HP BOILERS.

The country about Delray and Detroit is underlaid by a thick stratum of salt. Steam is required for evaporating the brine as pumped up from these depths, and the original design of the first Delray station included a surplus of boiler capacity in order that the four 3000-kw Curtis turbine sets might operate non-condensing, disposing of the exhaust steam to the salt refiners. Twenty-four 511-hp Stirling water-tube boilers were therefore installed, set in four batteries of six each. Each boiler contains 308 3¼-in. tubes, giving 4834 sq. ft. of heating surface. The second bank of tubes forms the superheater, with an area of 1500 sq. ft. and superheating to 600 deg. Fahr., or 200 deg. above the normal temperature of the steam at 210 lb. per sq. in. These boilers are equipped with Roney stokers, 104 sq. ft. of grate surface to the unit.

The outside groups of six boilers are served by two 132-ft. steel stacks, 11 ft. in diameter, and the inside double row by a 16-ft. stack of the same height. Induced draft for each battery of boilers is furnished by a 15-ft. fan,

engine-driven, the flues being so cross-connected as to enable the shutting down of any fan as required. A shaft rigging is now being arranged for simultaneously controlling the valves of all four fan engines from a single

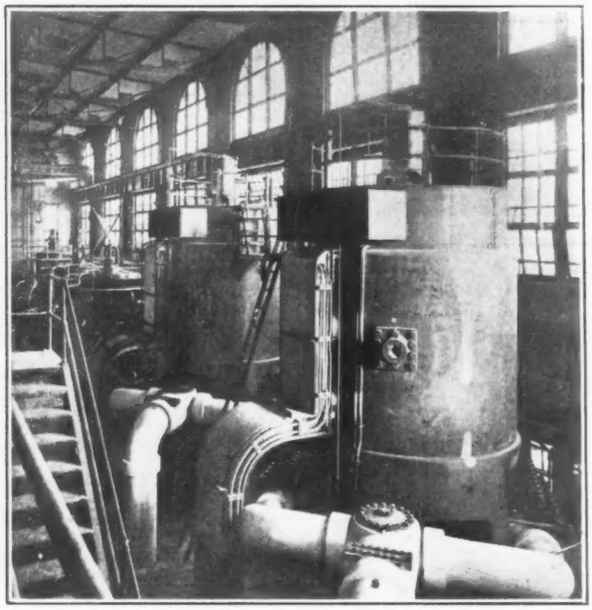


Fig. 2—9000-kw and 3000-kw Turbo-Generators in No. 1 Station.

governor, which will act to improve the speed regulation considerably.

As originally erected, the furnaces of these boilers in the No. 1 Delray station were each divided by a median wall 13½ in. in thickness, supporting the sprung masonry arches. These center walls have given some trouble, limiting the life of the ventilated arches to eighteen months or less. The experiment has accordingly been successfully tried of throwing together the stokers and two parts of the furnaces, replacing the two sprung arches by a single flat suspended arch, and so gaining all the advantages of a single large fire instead of two small ones. All of the boilers in this room will be similarly equipped with flat suspended arches, removing the center walls.

TURBINE EQUIPMENT IN NO. 1 STATION.

The first four turbo-alternators in the original Delray plant were 3000-kw, 4600-volt, 60-cycle, three-phase General Electric machines running condensing at 600 r.p.m. The plan for the evaporation of salt was never carried out, for the Edison company meanwhile found it convenient to meet its growing load by installing an additional 3000-kw turbine, without the necessity of adding any more boilers. The first four machines had a maximum rating of 4500 kw and the fifth exceeded this by 500 kw. Similarly the original four were equipped with water bearings using 1000 lb. per sq. in. pressure, and the fifth with oil step bearings at 800 lb. pressure. The installation of a separate accumulator when the new oil-bearing turbine was installed was avoided by arranging an 8-in. piston on the oil-pressure system, opposed by a 7-in. piston on the water system, so that the pressure adjustments of the water-borne accumulator are transmitted through to the oil bearing and are equally effective there.

The first four 3000-kw machines, installed in 1904, are now being replaced by 9000-kw alternators of similar type with a maximum rating of 11,000 kw each. Two of these larger units are now in place, as shown in Fig. 2. Each exhausts into a Worthington 16,000-sq. ft. surface condenser mounted as its base. The earlier 3000-kw units antedated the base type of construction, and therefore have their condensers installed in a condenser house adjoining the main turbine-room. The circulating pumps of the 9000-kw condensers are of the Worthington tri-rotor centrifugal type, having a capacity of 17,000 gal. per minute as driven at 720 r.p.m. by their 150-hp induction motors.

Circulating water for the condensing units in both plants is received through a screen house paralleling the main turbine-room. This screen house also contains the 75-hp, 18-in. centrifugal pumps for the 3000-kw units. The intake is through an entry canal extending out through the filled land in front of the power house and protected against floating ice at its outer end by a concrete sea-wall. Besides the outer fenders at this point for removing large debris, the water traverses sets of double screens in the screen house. These are so arranged that one can be hauled up by the screen-house motor crane and cleaned while the other remains in service. The screen house also contains the house service and fire pumps and an air compressor. A water-purification plant is later to be installed for the treatment of the boiler-feed water.

FEATURES OF NEW TURBINE AUXILIARY EQUIPMENT.

All of the auxiliaries of the new 9000-kw units are motor-driven, provision being made for bleeding steam from the second stage of the main turbine units for heating the feed water. Besides the compactness of such motor-operated auxiliaries, this arrangement, it is declared, results in a thermal efficiency at least equivalent to that with steam-driven auxiliaries, as in the case of the 14,000-kw units in Station No. 2.

Of special interest in connection with the new 9000-kw

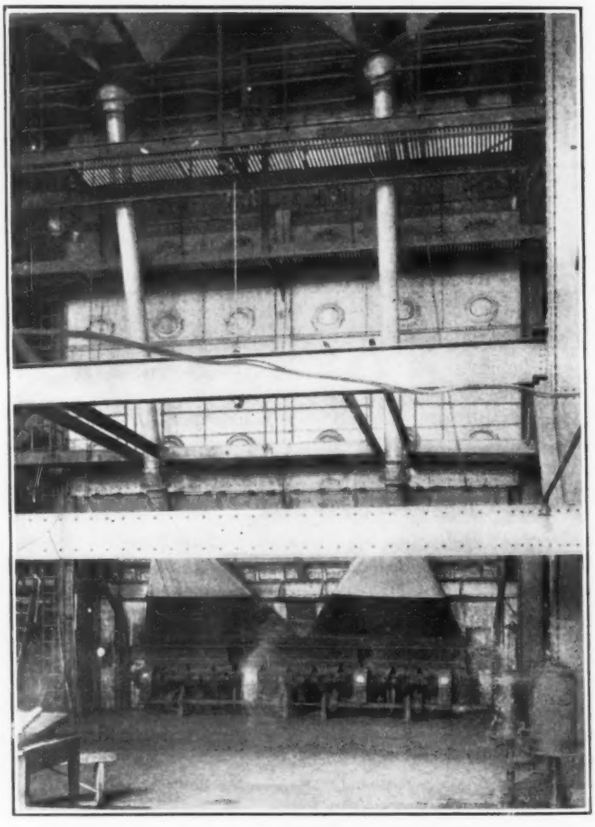


Fig. 3—Front of One of the 2365-hp Double-Fired Boilers.

sets are the motor-driven, four-stage centrifugal pumps which combine the functions of both hot-well and boiler-feed pumps. At a single step these pumps thus take the condensate from the hot wells, send it through the closed

feed-water heaters, and deliver it directly into the boilers through the economizers. While open-type feed-water heaters are used elsewhere in the plant, the closed heaters were rendered possible in the case of these combination pumps since the water handled, as condensed from the turbines, is pure and free from oil.

7,000-KW TO 11,000-KW FROM A SINGLE BOILER.

Principal interest in the Delray station surrounds, of course, the huge double-fired Stirling boilers, which have a rated capacity of 2365 hp on the basis of 10 sq. ft. of heating surface per hp. The normal output of each unit is, however, 7000 kw in regular service, and they have been drawn upon for 11,000 kw during short periods. Five of these huge boilers are now erected, the last two nearing

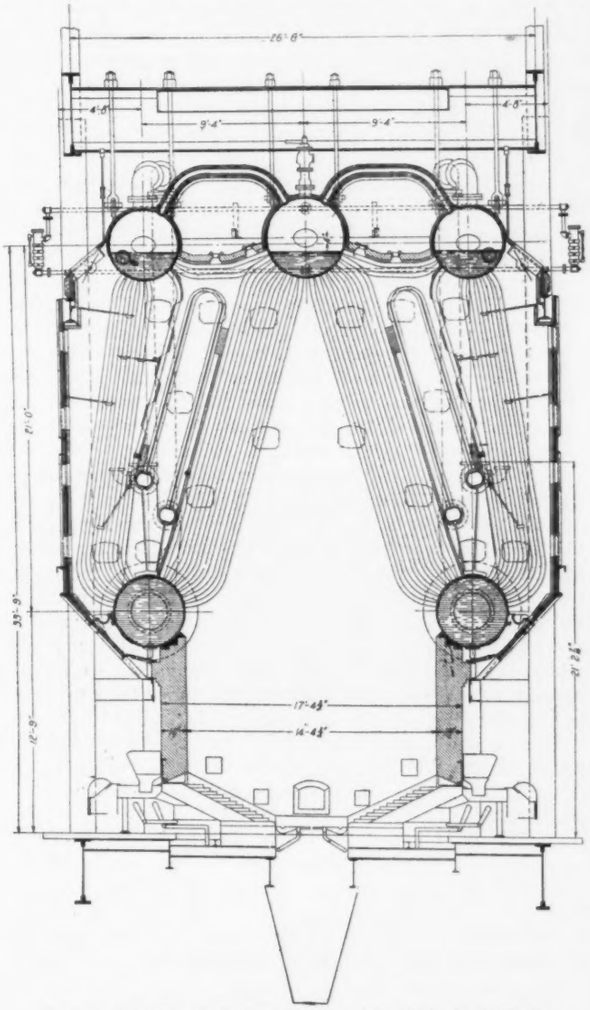


Fig. 4—Section of Boiler Fitted with Underfeed Stoker.

completion ready to operate, while the first three have been in service for periods ranging up to two years. The present boiler-room is now being duplicated on the west, where five 2365-hp units will be similarly installed in two rows, of three and an open pair respectively, giving a cross-aisle between the two rooms.

Following are the dimensions of these prodigious units:

Width, 31 ft.; height, 36 ft.; depth, 28 ft.

Total surface, 23,654 sq. ft.

Fifteen hundred and sixty-four 3¼-in. hot-drawn seamless tubes.

One 54-in. steam drum; two 48-in. steam drums; two 48-in. mud drums.

The boilers are fired from both ends, three being equipped with Roney stokers and two with Taylor underfeed stokers. The Roney stokers have 453 sq. ft. of grate surface, giving a ratio of 52 to 1 in heating to grate surface. The Taylor stokers have a nominal area of 300 sq. ft. with a heating-grate ratio of 79 to 1. The boilers

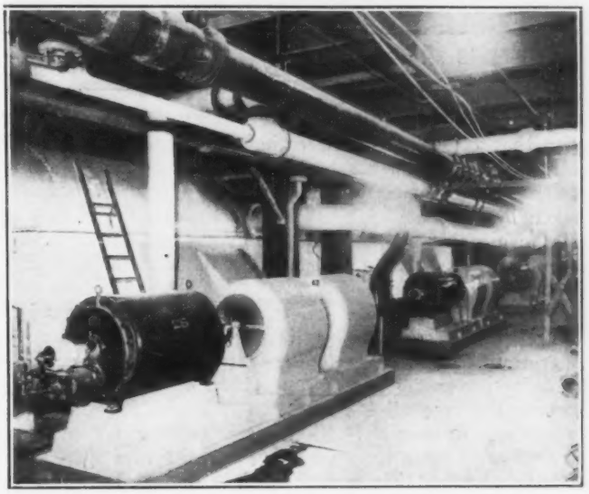


Fig. 5—Turbine-Driven Blowers in Basement for Underfeed-Stoked Boilers.

produce steam at 205 lb. pressure, superheated to 150 deg. Fahr. by traversing superheater coils mounted between the boiler tubes proper, as shown in Fig. 4. There are four water columns to each boiler, and each of the 54-in. steam drums is provided with eight 4½-in. safety valves, besides four 3-in. safety valves on the superheaters.

Forced draft is supplied to the two boilers equipped with the Taylor stokers by three double Sirocco blower sets exhausting into a common chamber. These blowers, which

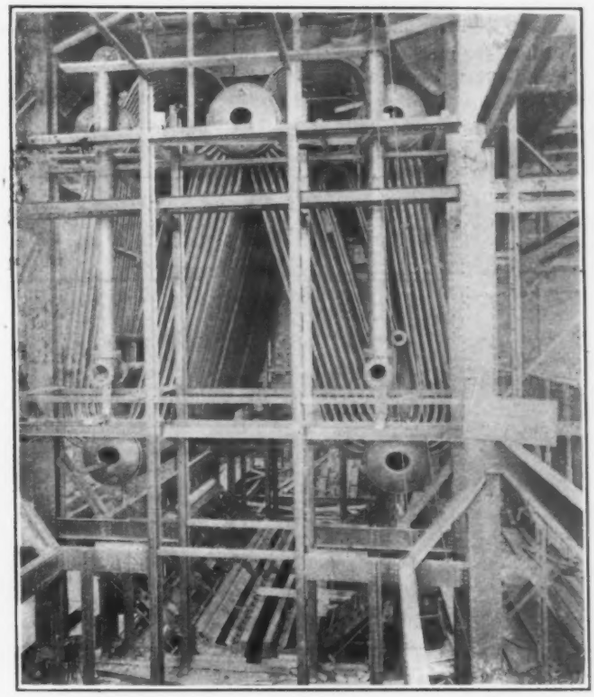


Fig. 6—2365-hp Boiler with Rocking-Grate Stokers, During Erection.

are mounted on the ash-basement level (Fig. 5), are driven in pairs by 175-hp Kerr steam turbines, running at 1710 r.p.m. and exhausting into the feed-water heaters.

The ashes from the boilers are discharged from hoppers

into ash cars running on a narrow-gage track in the basement. A small storage-battery electric "goat," constructed with the same wheel-base as the cars so as to take the short-radius curves, pushes the loaded ash cars out of the building, where they are taken in tow by a large electric locomotive capable of handling a train load and drawn to the dumping ground.

ADVANTAGES AND RESULTS OF LARGE BOILERS.

The idea of boiler units for Delray far exceeding in size that of the standard ratings was first suggested by Mr. Alex. Dow, general manager of the Detroit Edison company. The construction of the huge boilers was undertaken by the Babcock & Wilcox Company, the adaptation of the mechanical stokers and furnace construction being in charge of Westinghouse, Church, Kerr & Company, engineers for the station.

One of the 2365-hp boilers is equivalent to a whole battery of the smaller units in the older room, so that the operation of the large boilers brings all this steaming capacity under the closest supervision of the fireman, who can thus devote all his attention to regulating the single large fire. In answer to whatever objections may be raised to carrying such a huge steaming capacity in a single unit, it is pointed out that turbine sizes have long far exceeded even this boiler rating. The cube-square law of radiation, which works against the ventilation of the larger sizes of turbines without forced draft, acts to improve the efficiency of large boilers, for while their capacity increases with their cubical contents the radiation losses vary only with the square of their linear dimensions. Besides the increased efficiency of such large boilers, their first cost per hp of rating is less, they occupy smaller area per unit of output, and greatly simplify the number of pieces and arrangement of apparatus required in the boiler-room.

The repairs and maintenance of the large units have not exceeded the usual cost per hp with smaller sizes. Tube trouble has been practically negligible, as was expected from the experience already obtained with the smaller units in the No. 1 plant. The brickwork troubles anticipated have now been almost wholly overcome. The wall under the mud drum of one of the Taylor-stoked boilers,

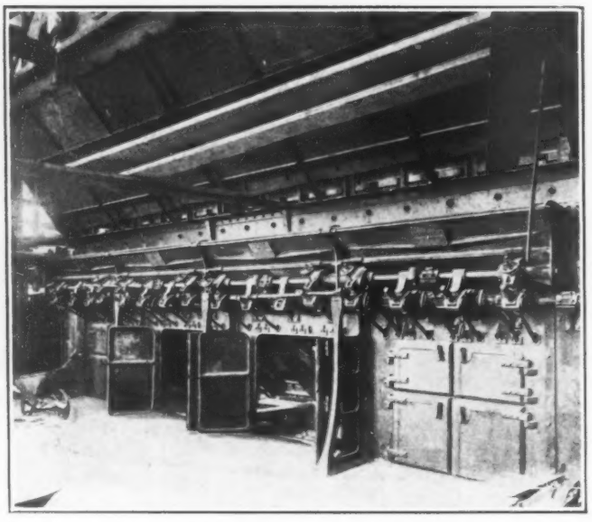


Fig. 7—Rocking-Grate Stokers for One End of Large Boiler.

now in use thirteen months, became deflected inward after about nine months' service, and required straightening, but this has now been anchored and should be good for an indefinite period of time.

With the Roney stokers the flat suspended-arch construction of the big furnaces has also made it possible to patch their brickwork with the greatest dispatch, when such repairs become necessary, at intervals of about three months. In fact, when required, a boiler in service on one peak load has been shut down, repaired, and put back in service for the peak of the following day.

ECONOMY TESTS OF DELRAY BOILERS.

Recently a series of tests on two of the 2365-hp Delray units was carried out under the direction of Dr. D. S.

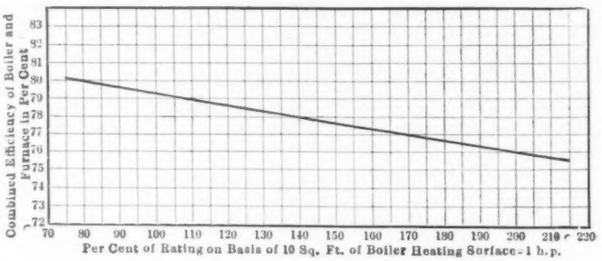


Fig. 8—Results of Tests of Large Boilers.

Jacobus, and this forms the subject of a paper presented by him Dec. 6 at the annual meeting of the American Society of Mechanical Engineers, reported in the *Electrical World* of last week. One boiler equipped with Roney stokers and one with Taylor stokers were studied, the test requiring the services of fifty men working in eight-hour shifts for six weeks. During this time 5000 tons of coal and 45,000 tons of water were measured.

The results obtained from Dr. Jacobus' tests show that with both classes of stokers the combined efficiency of both boiler and furnace ranges from 80 per cent at slightly below nominal rating to about 76 per cent at double rating. His data and observations are given in full in the current *Journal* of the A. S. M. E.

As already noted, the turbines driving the blowers for the Taylor stokers exhaust back into the feed-water heaters, the steam used for this purpose (which is reclaimed) amounting to 2½ to 3 per cent. The Roney stokers require about 1½ per cent of the total steam generated by the boilers, and except for about one-fifth of 1 per cent, which is similarly reclaimable from the stoker engine, the remainder is used in the form of jets under the grates and is therefore lost in the chimney products.

Each row of two or three large boilers is provided with a steel stack, 18 ft. in diameter and 250 ft. above the grates, these stacks being lined with common brick backed by concrete.

As has been stated, the large Delray boilers normally carry loads of 6000 kw, increasing this to 8000 kw during the evening peaks, while for short periods 11,000 kw has been easily handled per unit. The steam demand on each boiler is indicated in the fire-room by a manometer U-tube, filled with mercury, the arms of which bridge the superheater coils. On account of their restricted area, these coils act as a Venturi tube in the steam line, the output of the boilers being thus indicated directly on the manometer scale.

NO. 2 STATION AND ELECTRICAL EQUIPMENT

In next week's issue of the *Electrical World* the description of the Delray station will be completed with an account of the new No. 2 engine-room containing three 14,000-kw steam turbines. These units are ventilated directly from the engine-room, reversing the usual practice of leading in outside air through ducts. The special English type of steam valves used at Delray will also be of interest to American plant engineers. In these valves, which are constricted in gate area to one-quarter the normal cross-section, steam velocities of 10 miles per second are reached. An illustrated account of the electrical switching equipment, bus arrangement and distributing system will also be appended.

THE GENERATING AND TRANSMISSION SYSTEM OF THE TELLURIDE POWER COMPANY—IV.

Nunn and Olmsted Water-Power Stations of the Utah System—Future Development Involving Fall of 1725 ft., Producing 75,000 hp.

IN previous articles have been described the Colorado system of the Telluride Power Company, the general outline of the Utah system and some of its generating plants in detail. In the following other stations of this system are described:

NUNN'S STATION.

Although not an active part of the present system, the so-called Nunn's station of the company, near Provo, deserves brief mention. This installation has the distinction of being the first plant to be constructed by the Utah Department, work having been begun upon it in 1897. The station is located in Provo Canyon, about half way between the present Olmsted plant and the headworks of the latter. The station building, a stone structure 48 ft. x 65 ft., with two 20-ft. x 20-ft. wings, contains two 1000-hp Leffel reaction turbines, each connected through a flexible coupling to a 750-kw, 800-volt General Electric three-phase generator. Two 25-kw exciters are also provided, one being belt-driven and the other turbine-operated. The plant is connected with the flume of the Olmsted station by two 48-in. penstocks, the static head on the installation being about 123 ft. On account of the superior development later made at Olmsted the Nunn's station is no longer used, but at any time when it is required it can be again placed in service, provided the flume in the upper portion of the Olmsted headworks is enlarged.

OLMSTED STATION.

This plant, located about 6 miles above Provo, and at the outlet of Provo Canyon, adjacent to the headquarters offices of the company, has a rating of 7200 kw and takes water from a diversion of the river about 4.5 miles above through a 6-ft. x 8-ft. wooden flume leading downward from an intake at a rock-filled, timber-crib dam, 16 ft. high, 125 ft. long and having a 77-ft. spillway. The intake is of timber, tapering from its head to its tail end, with a mean section of about 6 ft. x 10 ft. Two lift gates are provided to control the flow. The last 1015 ft. of the flow line consists of tunnel through the rocky side of the mountain, and at the point where the tunnel begins an overflow has been installed to handle excess water in the flume. The flume terminates above the plant in a pressure box approximately 15 ft. x 28 ft. x 36 ft. in dimensions, the box being housed in and equipped with screens and wire-operated gates, controlling the influx of water into the penstocks. The pressure box is about 320 ft. above the power house, and is connected with the latter by three 874-ft. riveted steel penstocks, tapering in diameter from 5 ft. at the top to 4 ft. at the bottom. At the lower end the penstocks turn slightly to the left and enter the station at the level of the operating-room floor. The plant is housed in a brick building of 62 ft. x 85 ft. inside dimensions, concrete foundations being used. Draft tubes and discharge tunnels are also of concrete.

Fig. 28—View of Olmsted.

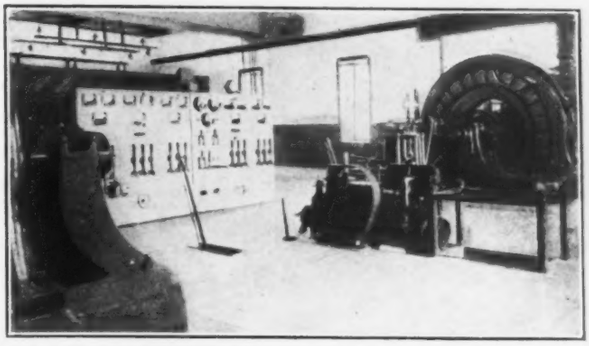


Fig. 29—Interior of Nunn's Station.

GENERATING UNITS.

Three Allis-Chalmers turbines are installed, each being of the inward-flow reaction type, with spiral casing and single horizontal runners. Each is capable of delivering 3600 hp when operating at a speed of 300 r.p.m. under a head of 330 ft., with a discharge of 117 cu. ft. per second. Lombard governors, operated by oil pressure supplied by a motor-driven pump, control the flow of water to each turbine, the turbine gates being of the swivel type. With the exception of a thrust bearing, no separate support is provided for the turbine shaft, the turbine runner being carried on the end of the generator shaft. Directly connected to each turbine on a horizontal shaft is a 2400-kw, 2300-volt, three-phase, 60-cycle General Electric revolving-field alternator. There are two 75-kw exciters in the plant, operated in each case at 270 r.p.m. by directly connected Pelton waterwheels rated at 100 hp. For the exciter service a 12-in. separate steel penstock is installed between the pressure box and the station, two 8-in. pipes branching from this to the small turbines at the bottom of the line. Lombard governors are provided for the latter units.

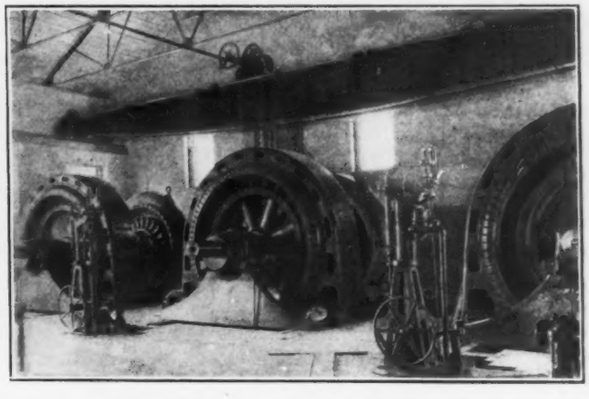


Fig. 30—Generating Units at Olmsted Station.

An eight-panel switchboard is installed in the center of the operating room in front of the generating units. It contains three generator panels, three panels for transformer bank and outgoing-line control, two Tirrill regulator panels and one exciter panel. The generator leads

are run along the ceiling of the basement to hand-operated, non-automatic oil switches beneath the switchboard. The arrangement provides for connecting any generator to a bank of corresponding transformers or the multiple operation of the generators upon a common bus. Energy for the city of Provo is taken from the 2300-volt bus and transmitted to the city over a 5000-volt line owned by the Provo Electric Company, the potential being raised in a small corrugated-iron building containing three 100-kw transformers, located adjacent to the Olmsted station. Energy for local station service at Olmsted, including the lamp and small motors used on the headquarters premises, is supplied from three 75-kw transformers distributing at 115 volts and 230 volts.

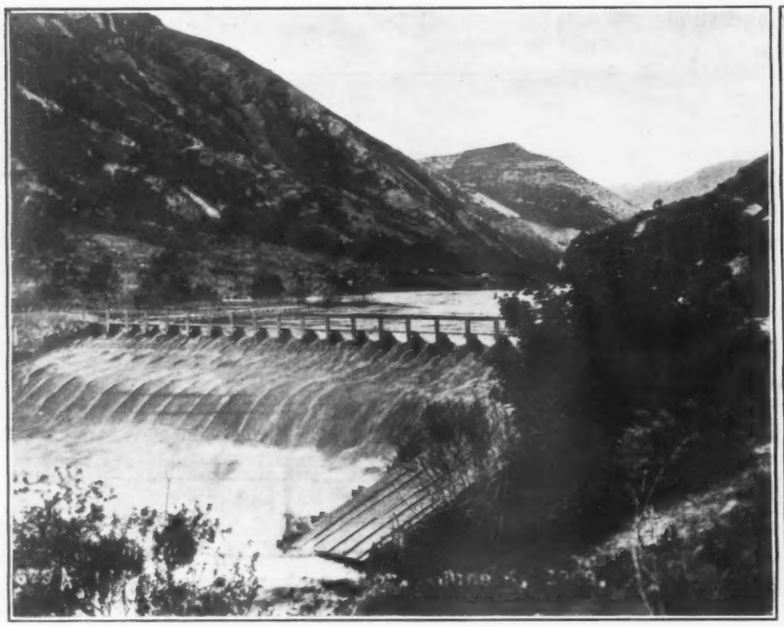


Fig. 31—Olmsted Dam.

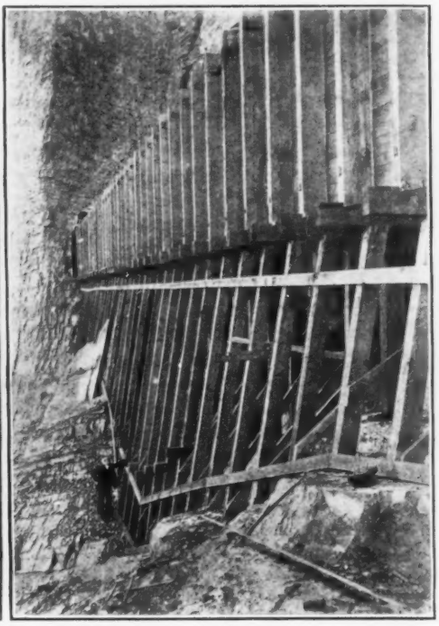


Fig. 33—Olmsted Flume.

HIGH-TENSION WIRING.

All high-tension switches in the plant are motor-operated, with remote control from the switchboard. The main trans-

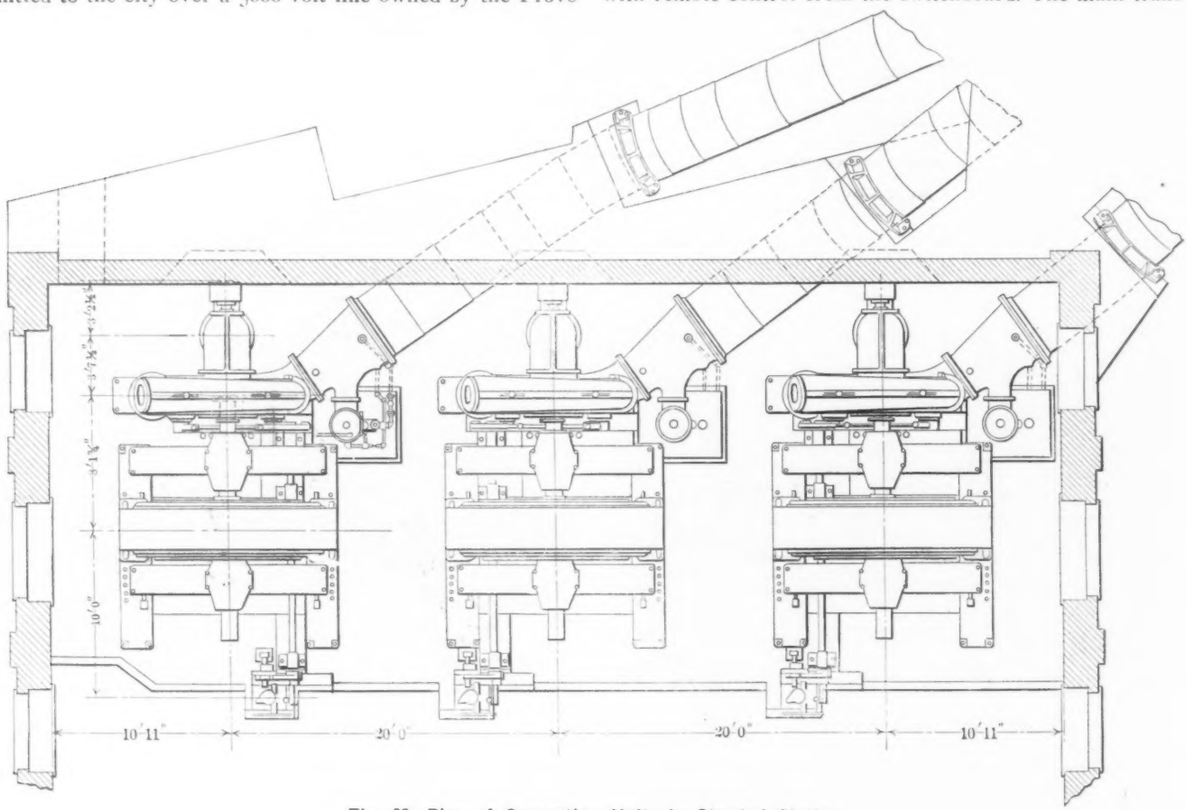


Fig. 32—Plan of Generating Units in Olmsted Station.

former installation consists of ten 1000-kw water-cooled units, located in a depressed bay at the east end of the operating room, the space behind the transformers being

occupied by the high-tension switches, which are mounted in brick cells. The transformers are connected with the outgoing lines and overhead 44,000-volt bus by cables protected in fiber conduit sleeves. The entire east end of the operating room is occupied by high-tension switches and an overhead framework of varnished wood carries

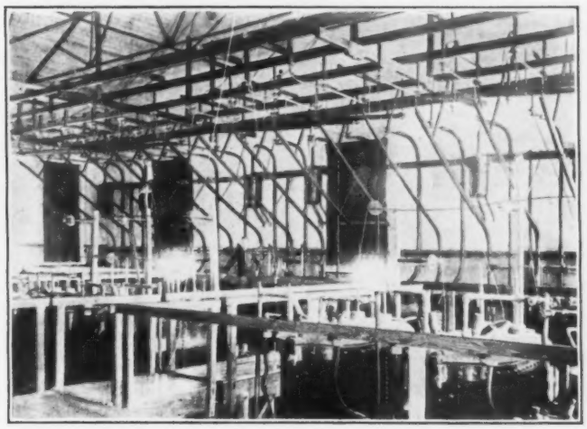


Fig. 34—High-Tension End of Olmsted Station.

the outgoing and transfer circuits on glass insulators mounted on treated locust pins. Disconnecting switches are installed on each side of the high-tension oil switches, and these are so arranged that the disconnectors from the transformer secondaries can also be connected directly to the line when desired, thereby maintaining continuous service in spite of the cutting off of a high-tension oil switch. The framing carrying the high-tension lines is mainly 4-in. x 6-in. timber, varnished. The outgoing lines are equipped with aluminum-cell and low-equivalent arresters, choke coils and outlet bushings of fiber conduit and insulating compound, run in sewer tile. The lines leaving the station are protected from the weather by a galvanized-iron hood and are equipped with a grounding mechanism actuated by levers in the operating room.

FUTURE POWER DEVELOPMENT.

The resources of the company provide for an extensive future development of hydroelectric power on the Utah system, with the possibility of smaller additions to the generating system in Colorado. An important enlargement of the facilities of the Utah system is now under way in the Bear Lake district. Bear Lake is a natural body of deep water about 140 sq. miles in area, lying in a mountainous basin surrounded on two sides by the Wasatch range and on the third by highlands. Its extension to the north, cut off from the main body by a sandbar, is alternately marsh and open water, the supply being from surface drainage and extensive springs from underground channels fed from the upper reaches of the Bear River. Bear River no longer flows through or into these lakes, but skirts them a few miles away and receives the natural outflow from the lakes. In 1907 Mr. L. L. Nunn secured all rights to this water under special governmental grant, and subsequently the development has been continuous. The lake is the second largest body of fresh water in the Great Basin.

BEAR LAKE IMPROVEMENTS.

The general plan of development is to equalize the flow of Bear River by drawing down the lakes during low-water season a possible 10 ft., by means of 16 miles of canal discharging into Bear River, and then refilling it during the flood season by means of another canal 4 miles long, from a point about 15 miles upstream. The final development will consist of a diverting dam and gateworks opening into the inlet canal, about 150 ft. wide x 12 ft. deep; about 6 miles of levees along the northern border and a large outlet gate works about 20 ft. high, leading to an outlet canal about 100 ft. wide by 6 ft. in working depth, the length being 16 miles. At present this development includes concrete gate works of about one-third capacity and a similarly reduced inlet canal, besides 2 miles of dike and about 4 miles of single-outlet canal, which is being pushed forward at the rate of about 1 mile per month. About 4500 sq. miles of drainage area are involved in the work of storage and flow equalization. A total of about 250,000 theoretical hp is estimated as available in the total fall of 1725 ft. between Bear and the Great Salt Lakes. This volume, utilized at the existing Grace development, is estimated as capable of producing 75,000 hp.

At Oneida Narrows, about 23 miles below Grace, the river passes through two narrow gorges associated with open valleys, which may be utilized as peak-load reservoirs. The flow at Oneida, estimated at 1600 cu. ft. per second, compared with a considerably smaller volume at Grace, is estimated as capable of developing 32,600 hp.

The conclusion of the series of articles on the generating and transmission system of the Telluride Power Company will follow in the next issue.

THE CHARACTERISTICS OF SERIES INSTRUMENT TRANSFORMERS—II.

Determination of the Effect of the Magnetic-Circuit Characteristics on the Current Ratio and Time-Phase Displacement.

BY ARTHUR P. YOUNG.

IN the first instalment of this article, which appeared in the issue dated Dec. 9, the current ratio in series transformers was discussed at some length, and attention was drawn to the importance of the time-phase displacement between the primary and secondary currents.

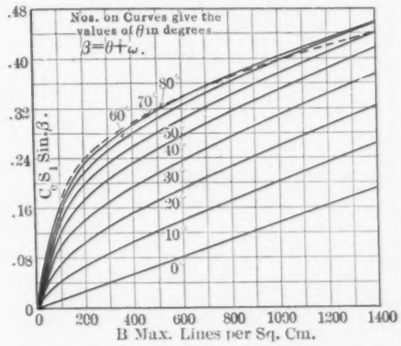


Fig. 5—Variation of Exciting Current with Magnetic Density.

The present instalment relates particularly to the phase-displacement features of the transformer.

EFFECT OF FREQUENCY VARIATION.

From equation (15)

$$\tan\theta = kf$$

where

$$k = \frac{2\pi L_2}{R_2 + R_s} = \frac{\tan\theta}{f} \qquad (18)$$

Also,

$$\cos^2\theta = \frac{1}{1+\tan^2\theta}$$

therefore,

$$\cos\theta = \frac{1}{\sqrt{1+k^2f^2}}$$

Substituting this value of cos θ in equation (14),

$$e_2 = C_2\,(R_s + R_2)\,\sqrt{1+k^2f^2} \qquad (19)$$

These equations show how e_2 and θ vary with the frequency f. If the values of θ and e_2 at any given frequency are known the values at any other frequency can readily be calculated by aid of these formulas. To enable this to be done rapidly a number of curves have been plotted showing

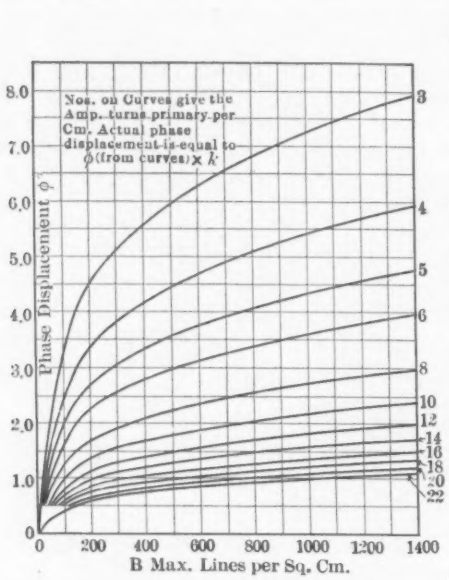

Nos. on Curves give the Amp. turns primary per Cm. Actual phase displacement is equal to ϕ (from curves) x k
Phase Displacement ϕ
B Max. Lines per Sq. Cm.

Fig. 6—Phase Displacements Between Primary and Secondary Currents for Low-Current Values.

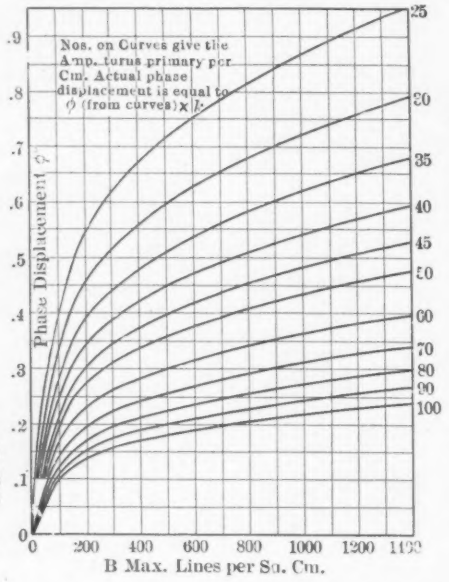

Nos. on Curves give the Amp. turns primary per Cm. Actual phase displacement is equal to ϕ (from curves) x k
Phase Displacement ϕ
B Max. Lines per Sq. Cm.

Fig. 7—Phase Displacements Between Primary and Secondary Currents for Large Current Values.

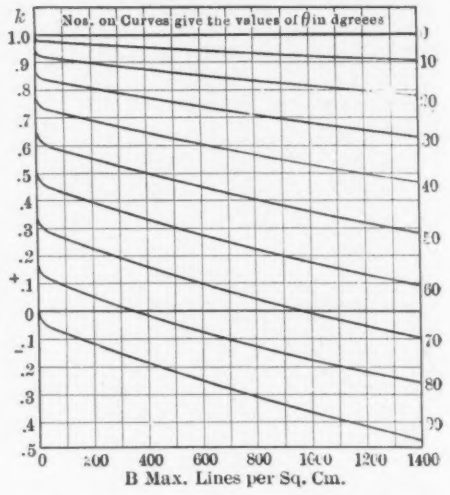


Fig. 8—Ratios of Cosines of Time-Phase Angles for Various Secondary-Phase Displacements.

highly inductive. If any particular case be considered and curves plotted corresponding to, say, 25 cycles, 50 cycles and 100 cycles respectively, firstly, assuming θ = zero, which, of course, represents an absolutely non-inductive load, and, secondly, with θ = 60 deg., which corresponds to a highly inductive load, by aid of these curves one can deduce laws governing this effect which are quite general in their application. They can be enunciated as follows:

(1) Lag of Secondary Current Small.

(a) Decreasing the frequency gives a slightly worse ratio characteristic.

(b) Decreasing the frequency gives a much worse phase displacement characteristic.

(2) Lag of Secondary Current Large.

(a) Decreasing the frequency improves very slightly the ratio characteristic.

(b) Decreasing the frequency gives a much worse phase displacement characteristic, the magnitude of the errors so produced being practically the same as in the previous case.

how e_2 decreases with the frequency. These are shown in Fig. 10. It is assumed that the value of e_2 at 100 cycles is known and the percentage drop in e_2 is given for lower frequencies, the number on each curve being the value of θ at 100 cycles. Another set of curves shows how θ decreases with the frequency.

By aid of these curves one can quite easily determine the ratio and phase displacement characteristics of a transformer operated at different frequencies. For suppose that by means of equations (14) and (15) the value of e_2 and θ at 100 cycles corresponding to given load conditions has been calculated. Then by referring to the curves given in Fig. 10 the value corresponding to some lower frequency can at once be determined, and from the value of e_2 so deduced the corresponding value of B_m can be found by employing equation (16). The values of θ and B_m being known for the particular frequency, the ϕ and K_a curves can be plotted in the manner previously described by simply referring to the various curves shown in Figs. 5, 6, 7 and 8.

This question is of practical importance, and the above method affords a ready means of investigating the problem as to what extent the characteristics of a transformer

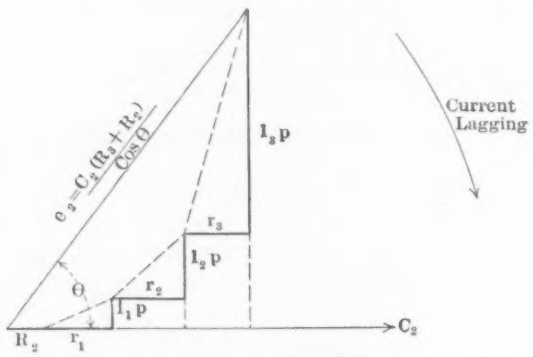


Fig. 9—Vector Representation of Secondary Load.

are affected when it is used on different frequencies, other things being the same. There are two cases which have to be considered—the first, in which the secondary load is practically non-inductive, and the second, in which it is

PHASE DISPLACEMENT IN WATTMETERS AND WATT-HOUR METERS.

The phase displacement in wattmeters is of sufficient

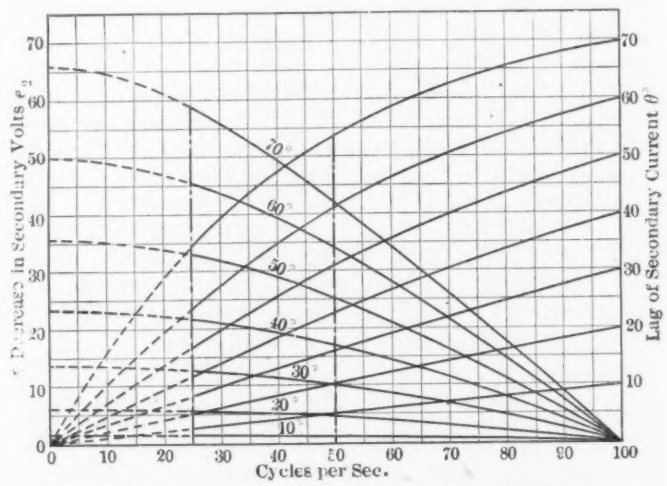


Fig. 10—Variation of Secondary Voltage with Frequency.

practical importance to warrant it being considered separately. The accuracy of a wattmeter or watt-hour meter is greatly dependent on the phase displacement ϕ of the series transformer with which it is operating, particularly

so when the power-factor of the circuit is low. This applies not only to wattmeters, but, in general, to all instruments having both current and potential windings. such, for instance, as a power-factor indicator. Considering the general case in which ϕ is positive, the effect is to make a wattmeter read high on inductive loads. This can be readily understood by referring to the vector diagram given

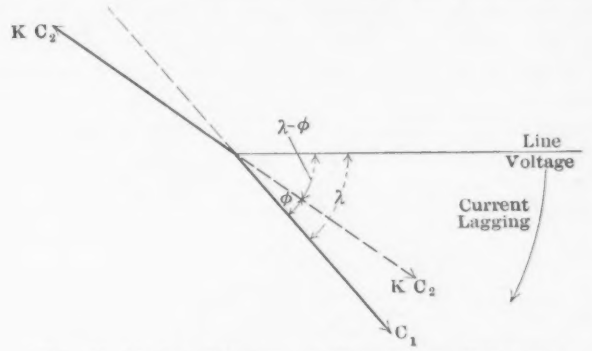


Fig. 11—Vector Diagram of Time-Phase Relations.

in Fig. 11. Suppose that the primary current C_1 lags behind the line voltage V by the angle λ, then

$$\text{true power} = W = C_1 V \cos \lambda$$

power measured by wattmeter $= W_r = C_2 K V \cos (\lambda - \varphi)$. It can be assumed that the current ratio is equal to K as the error due to any discrepancy between K_a and K is independent of λ. This gives

$$W_r = C_1 V \cos (\lambda - \phi)$$

and

$$\text{per cent error in wattmeter reading} = \frac{(W_r - W)}{W} \times 100$$

per cent error in wattmeter =

$$\left\{ \frac{\cos (\lambda - \phi) - \cos \lambda}{\cos \lambda} \right\} \times 100 \quad (20)$$

The errors corresponding to different values of λ for various values of ϕ ranging from 0.1 deg. to 3 deg. are shown by a series of curves given in Fig. 12. It is seen that with $\phi = 0.5$ deg. the error corresponding to $\lambda = 60$ deg.—that is, a power-factor $= 0.5$—is 1.5 per cent. It would appear from this that ϕ should be kept well within 0.5 deg. even down to very small loads in view of the fact that the specifications for watt-hour meters often allow an error of only 2 per cent in the meter reading due to a variation in power-factor from unity down to 0.5.

It should be pointed out, however, that in cases where watt-hour meters have to operate in conjunction with series transformers most manufacturers make a point of calibrating the meter with the transformer, connecting in series with it the actual or an equivalent secondary load, and do not guarantee their meters unless this has been done. If the meters are of the induction type, as is nearly always the case, the phase error due to the transformer is compensated for by means of the lagging adjustment provided on all meters of this type, so that it is made to read correctly on, say, a power-factor of 0.5 with full-load current passing through the series winding of the meter. By means of the low-load adjustment on the meter the variation of current ratio with load is also compensated for, but it is apparent that the meter will register correctly only when operating under exactly the same conditions as those under which it was originally calibrated. If it is desired to change the transformer or vary the load, the meter should be calibrated under the new conditions, and this is enforced by most manufacturers.

Due to the fact that the phase displacement ϕ increases as the load decreases it is obvious that the meter will not read correctly on low power-factors when the load is very small, even if it has been carefully calibrated in the manner previously described. An example illustrating this rather important effect will be given later.

ILLUSTRATION OF THE FOREGOING METHODS OF ANALYSIS.

At this point it seems well to summarize the methods of analysis described in detail above by applying them to an actual design. For this purpose there has been chosen a 2000-amp, 400-to-1 ratio series transformer of the "ring" pattern manufactured by one of the leading makers of this class of apparatus. The primary consists simply of a straight copper rod fixed axially with respect to a tubular iron core built up from ring punchings of "stalloy" iron. The secondary winding, which is designed to carry 5 amp at full load, is distributed uniformly around the iron core.

This particular form of design is extremely neat, and can be successfully employed for primary currents above 500 amp. It lends itself readily to the methods of determining the essential characteristics developed in this article, because in all such designs the magnetic leakage between primary and secondary must of necessity be nil, and therefore the assumption with which the present investigation was commenced is strictly correct.

The linear dimensions of the magnetic circuit of the particular series transformer taken as an example are clearly shown in Fig. 13. The essential information with regard to the transformer can be tabulated as follows:

Primary amperes at full load $= C_1 = 2000$.
Primary turns $= S_1 = 1$.
Secondary turns $= S_2 = 396$.
Theoretical ratio $= S_2 \div S_1 = K = 396$.
Rated ratio $= 400$.
Primary ampere-turns at full load $= 2000$.
Mean length of magnetic circuit, centimeters $= 32.4$
$\therefore C_1 S_1$ per centimeter at full load $= 61.8$.
Cross-section of core, square centimeters $= A = 7.8$.
Resistance of secondary, ohms $= R_2 = 0.45$.

For the secondary load consider a very common case in which an ammeter, wattmeter and trip coil are connected in series across the secondary winding. The following information as regards resistance and reactance was obtained experimentally, using a 5-amp ammeter and watt-hour meter of well-known manufacture, and a trip coil wound also for 5 amp, so that the values given can be taken as representing average load conditions, particularly as the full-load secondary current of series transformers has been practically standardized at 5 amp.

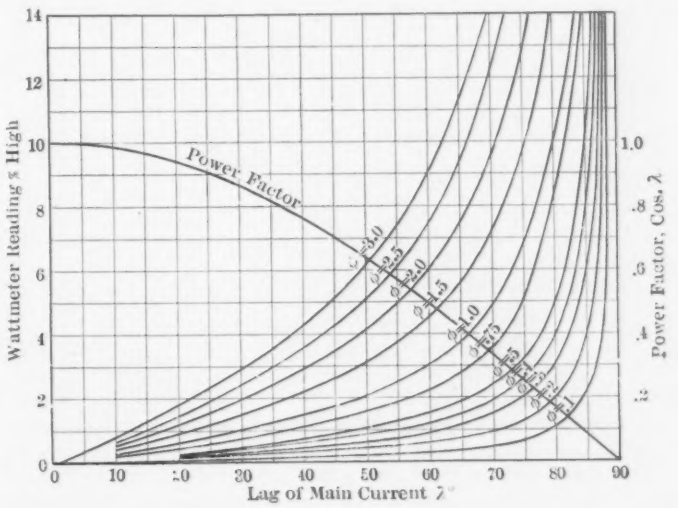


Fig. 12—Error of Wattmeter Reading at Different Lag Angles.

The values given for the reactances in the following table are for 100 cycles per second.

Resistance of ammeter,	ohms $= r_1$	$= 0.11$
Reactance of ammeter,	ohms $= pl_1$	$= 0.3$
Resistance of wattmeter,	ohms $= r_2$	$= 0.06$
Reactance of wattmeter,	ohms $= pl_2$	$= 0.15$
Resistance of trip coil,	ohms $= r_3$	$= 0.235$
Reactance of trip coil,	ohms $= pl_3$	$= 1.19$

First of all will be determined the characteristics at a frequency of 100 cycles per second.

Determination of B_m and θ at 100 Cycles.

$$R_2 = r_1 + r_2 + r_3 = 0.405$$
$$pL_2 = pl_1 + pl_2 + pl_3 = 1.64$$

Therefore $\tan\theta = 1.92$ from equation (15)

hence $\theta = 62.5$ deg.

and $\cos\theta = 0.463$.

The value of B_m at full load will now be calculated by using equation (17) and assuming $C_2 = 5$.

Thus:

B_m at full load = 672 lines per square centimeter.

Determination of Current Ratio K_a at 100 Cycles.

Knowing the value of B_m corresponding to full load one can readily calculate the corresponding value for any other load by assuming that B_m is simply proportional to the primary current—that is, to the value of C_1S_1 per centimeter. This, of course, is not strictly correct and would be true only if $C_1 \div C_2 = K_a$ was constant for all values of C_1. As, however, this ratio will not vary by more than 2 per cent over a very wide range of load, the errors introduced by assuming direct proportionality between B_m and C_1 are quite negligible.

Referring to the curves given in Fig. 5, the values of $C_0S_1 \sin\beta$ corresponding to different loads ranging between full load and 5 per cent of full load are determined and tabulated as follows:

Per Cent of Full Load.	Primary Current $=C_1$ Amp.	C_1S_1 per Cm. $= x$.	B_m	θ Deg.	$C_0S_1 \sin\beta$ from Curves $= y$.	$(x-y)$	$\frac{x}{x-y} = z$.	$K_a = KZ$	Per Cent Error in Ratio, K_a.
100	2,000	61.8	672	62.5	.343	61.457	1.0056	398.22	−0.45
80	1,600	49.4	538	62.5	.316	49.084	1.0063	398.50	−0.38
60	1,200	37.1	403	62.5	.286	36.814	1.0078	399.09	−0.23
40	800	24.7	269	62.5	.246	24.452	1.010	399.96	−0.01
20	400	12.4	134	62.5	.186	12.214	1.0152	402.02	+0.50
10	200	6.2	67	62.5	.124	6.076	1.0204	404.08	+1.02
5	100	3.1	34	62.5	.080	3.020	1.0265	406.5	+1.62

Determination of Phase Displacement Φ at 100 Cycles.

By referring to the curves given in Figs. 6 and 7 one can readily determine the value of the phase displacement ϕ, assuming $\theta =$ zero for corresponding values of Bm and C_1S_1 per centimeter. Then from Fig. 8 are obtained the values of the constant k corresponding to the various values of B_m considered, assuming $\theta = 62.5$ deg. in each case. The tabulation is as follows:

Per Cent of Full Load.	Primary Current $=C_1$ Amp.	C_1S_1 per Cm. $= x$.	B_m	θ Deg.	ϕ from Curves $= \phi_1$ Deg.	k from Curves.	Phase Displacement $\phi = k\phi_1$ Deg.
100	2,000	61.8	672	62.5	0.31	0.22	0.07
80	1,600	49.4	538	62.5	0.37	0.25	0.09
60	1,200	37.1	403	62.5	0.45	0.29	0.13
40	800	24.7	269	62.5	0.60	0.33	0.20
20	400	12.4	134	62.5	0.91	0.38	0.35
10	200	6.2	67	62.5	1.21	0.40	0.48
5	100	3.1	34	62.5	1.67	0.415	0.69

Determination of the Characteristics at 50 Cycles and 25 Cycles.

First must be determined the values of B_m at full load and θ for each periodicity. This can be done by aid of the curves given in Fig. 10, from which the values of θ corresponding to 50 cycles and 25 cycles respectively can be deduced at once, and the ratio between the voltage drop in the secondary (e_2) on either periodicity and that occurring on 100 cycles can also be determined. An examination of equation (16) will make it clear that if for any frequency f_1 the per cent drop in e_2 as found from the curves is n, then B_m at full load on frequency $f_1 = \frac{100 - n}{f_1} \times B_m$ at full load on 100 cycles.

For 50 cycles and 25 cycles the following results are obtained:

Cycles.	θ Deg. from Curves.	n	B_m
50	44.0	36	834
25	26.2	48	1,370

(a) Current Ratio (K_a) Characteristic on 50 Cycles and 25 Cycles.

Proceeding in exactly the same way as in determining the ratio characteristic on 100 cycles, using, of course, the values of θ and B_m, as given above for each periodicity, the following results are obtained:

CURRENT RATIO AT 50 CYCLES.

Per Cent of Full Load.	Primary Current $=C_1$ Amp.	C_1S_1 per Cm. $= x$.	B_m	θ Deg.	$C_0S_1 \sin\beta$ from Curves $= y$.	$(x-y)$	$\frac{x}{x-y} = Z$	$K_a = KZ$	Per Cent Error in Ratio K_a.
100	2,000	61.8	834	44	0.332	61.468	1.0054	398.14	−0.47
80	1,600	49.4	667	44	0.300	49.100	1.0061	398.42	−0.40
60	1,200	37.1	500	44	0.266	36.834	1.0072	398.85	−0.29
40	800	24.7	334	44	0.227	24.473	1.0093	399.68	−0.08
20	400	12.4	167	44	0.170	12.23	1.0139	401.51	+0.38
10	200	6.2	83	44	0.114	6.086	1.0187	403.41	+0.85
5	100	3.1	42	44	0.074	3.026	1.0245	405.7	+1.42

CURRENT RATIO AT 25 CYCLES.

Per Cent of Full Load.	Primary Current $=C_1$ Amp.	C_1S_1 per Cm. $= x$.	B_m	θ Deg.	$C_0S_1 \sin\beta$ from Curves $= y$.	$(x-y)$	$\frac{x}{x-y} = Z$	$Ka = KZ$	Per Cent Error in Ratio K_a.
100	2,000	61.8	1370	26.2	0.350	61.45	1.0057	398.26	−0.43
80	1,600	49.4	1096	26.2	0.304	49.096	1.0062	398.45	−0.39
60	1,200	37.1	822	26.2	0.258	36.842	1.0070	398.77	−0.31
40	800	24.7	548	26.2	0.206	24.494	1.0084	399.32	−0.17
20	400	12.4	274	26.2	0.156	12.244	1.0127	401.04	+0.26
10	200	6.2	137	26.2	0.104	6.096	1.0171	402.78	+0.69
5	100	3.1	69	26.2	0.065	3.035	1.0214	404.47	+1.12

(b) Phase Displacement (ϕ) Characteristics on 50 Cycles and 25 Cycles.

Using corresponding values of B_m and θ as previously determined for 50 cycles and 25 cycles respectively, there are obtained by aid of the curves given in Figs. 6, 7 and 8 the results here shown.

PHASE DISPLACEMENT AT 50 CYCLES.

Per Cent of Full Load.	Primary Current $=C_1$ Amp.	C_1S_1 per Cm. $= x$.	B_m	θ Deg.	ϕ from Curves $= \phi_1$ Deg.	k from Curves.	Phase Displacement $\phi = k\phi_1$ Deg.
100	2,000	61.8	834	44	0.33	0.5	0.17
80	1,600	49.4	667	44	0.39	0.54	0.21
60	1,200	37.1	500	44	0.48	0.57	0.27
40	800	24.7	334	44	0.64	0.61	0.39
20	400	12.4	167	44	1.01	0.65	0.66
10	200	6.2	83	44	1.38	0.67	0.92
5	100	3.1	42	44	1.90	0.68	1.29

PHASE DISPLACEMENT AT 25 CYCLES.

Per Cent of Full Load.	Primary Current $=C_1$ Amp.	C_1S_1 per Cm. $= x$.	B_m	θ Deg.	ϕ from Curves $= \phi_1$ Deg.	k from Curves.	Phase Displacement $\phi = k\phi_1$ Deg.
100	2,000	61.8	1370	26.2	0.38	0.70	0.27
80	1,600	49.4	1096	26.2	0.45	0.73	0.33
60	1,200	37.1	822	26.2	0.56	0.77	0.43
40	800	24.7	548	26.2	0.74	0.80	0.59
20	400	12.4	274	26.2	1.20	0.84	1.01
10	200	6.2	137	26.2	1.85	0.86	1.59
5	100	3.1	69	26.2	2.5	0.87	2.17

CONCLUSION.

The ratio and phase-displacement values deduced above when plotted as curves, as in Fig. 14, show very clearly how the characteristics are affected by frequency changes. It will be noted that a change in frequency from 100 cycles to 25 cycles only slightly affects the ratio characteristics, the characteristic, however, being somewhat better on the lower frequency. On the other hand, the phase displacement characteristic is much worse on 25 cycles, ϕ being 0.69 deg. at 5 per cent of full load on 100 cycles as compared with 2.2 deg. at the same load on 25 cycles. A reference to the earlier part of this paper dealing with "Effect of Frequency Variation" will show that these results corroborate the general laws governing such variations there given for cases in which the lag of the secondary current is large.

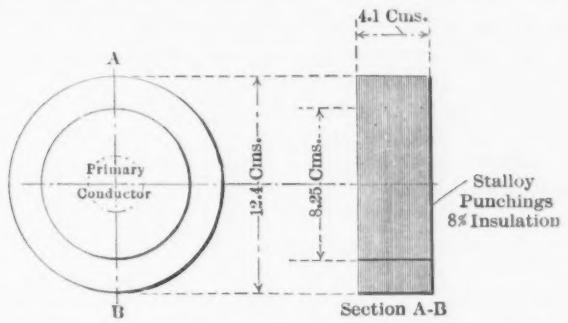


Fig. 13—Details of a Series Transformer Core; 2000 Amp to 5 Amp.

All the formulas given in this article have been deduced on the supposition that there is no magnetic leakage between the primary and the secondary, and, therefore, the various curves plotted can be strictly employed only in cases where this fundamental assumption is true. In all cases where the transformer is of the "straight-through" type, such as taken in the example, the magnetic leakage is nil, and it is therefore reasonable to suppose that in cases where the methods of analysis described in this paper are applied the results obtained will be very reliable—probably more so than those obtained experimentally by carrying out lengthy tests employing necessarily delicate measuring apparatus. Even in cases where there is magnetic leakage, for instance, as when the primary and secondary coils are arranged side by side on one limb of a closed iron circuit, it will always be very slight, provided the design has been carefully carried out, and will probably

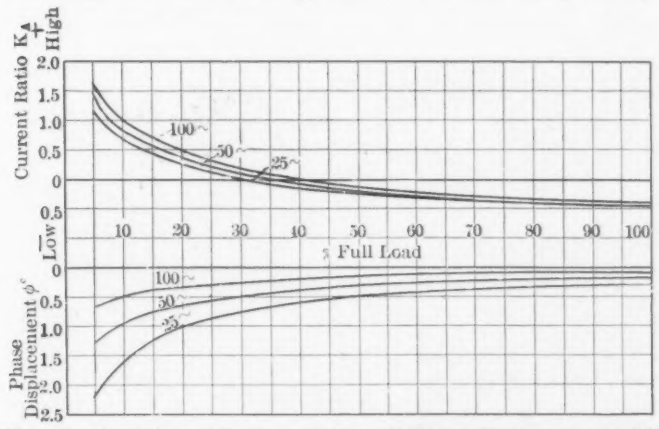


Fig. 14—Variation of Current Ratio and Phase Displacement with Load at Different Frequencies.

be such that with the secondary short-circuited on itself there will be a lag in the secondary circuit of from 20 deg. to 30 deg.—that is, θ is from 20 deg. to 30 deg. This will have but little effect in cases where the secondary circuit is highly inductive, and, taking the other extreme, the effect of magnetic leakage will be to make the ratio characteristic slightly worse and the phase displacement characteristic slightly better than the corresponding curves obtained by this method. It would, therefore, seem that for ordinary commercial purposes the results obtained by neglecting leakage will be sufficiently accurate.

In conclusion, there is one other point in connection with this subject which is worthy of note. It was pointed out earlier in the paper that in cases where a watt-hour meter has to operate in conjunction with a series transformer it is customary to calibrate the meter with the transformer, compensating for the phase error by adjustment on an inductive load having a power-factor of 0.5 with full-load current passing through the primary of the transformer. As ϕ increases with decrease of load it follows that after adjusting the meter in this way it will not read correctly on low power-factors if the load on the transformer is less than normal full load. A number of curves have been plotted in Fig. 15 for the particular transformer taken as an example, giving the errors arising in this way on inductive loads varying between full load and one-twentieth full load at 50 cycles for power-factors down to 0.3. These have been plotted from the phase-displacement curves given in Fig. 14 for 50 cycles by aid of the curves given in Fig. 12. It will be noticed that on low loads the errors are very considerable, on a power-factor of 0.5 at one-twentieth full load the error being as much as 3.4 per cent. It is, of course, impossible to compensate for these errors. These particular curves afford a very good illustration of the importance of reducing the phase errors to a minimum by careful attention to all points in the design which tend to produce this result.

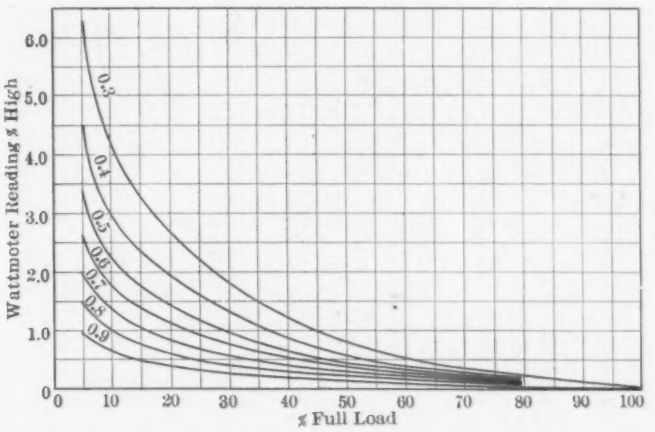


Fig. 15—Variation in Error in Wattmeter Readings with Load at Different Power Factors.

ELECTRIC STREET-CLEANING APPARATUS.

A type of electric street-cleaning machine which has been introduced into a number of German cities, for instance, Berlin, Schöneberg, Charlottenburg, Hanover, Trier, Strassburg, Dresden and Hamburg, is shown in Fig. 1. These machines have been built for Herrn Baurat Szalla, Berlin, by Hentschel & Company, Berlin, and have given excellent service for the last few years.

After having made exhaustive experiments it was decided to use the electric system of propulsion for the following reasons: It is hygienically perfect, being absolutely odorless and almost noiseless; it is simpler to operate than the gas engine and gives less trouble and has fewer repairs. One of the most favorable characteristics of the electric power was the possibility of retaining the same type of cleaner as was developed for use with horses. This type takes up a minimum of room and can be turned around with the least disturbance of street traffic. The electric motor permits the highest attainments in this direction.

Such a machine can be turned upon one hind wheel as a center within a space of about 20 ft. width, so that it can be turned around in the narrowest streets without the least trouble, while a benzine machine requires a street at least 40 ft. wide to permit its turning around.

The cleaning machine consists of cylindrical water tank

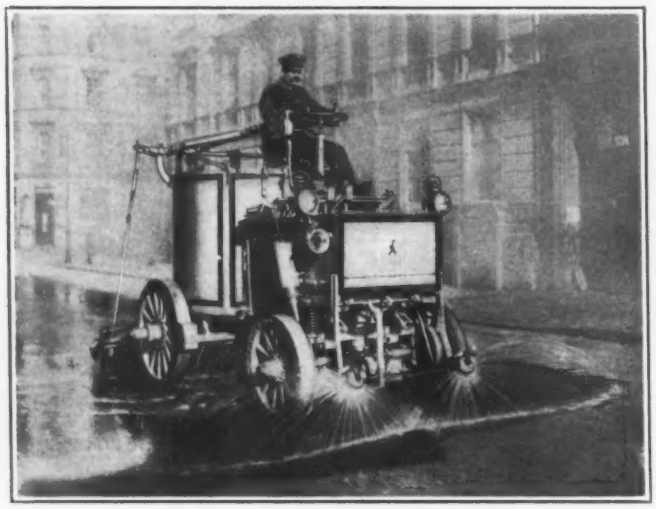


Fig. 1—Electric Street-Cleaning Machine.

mounted on four wheels provided with ball bearings and steel tires. The tank holds 660 gal. and carries the driver's seat. Under the tank are located the shower pipes, which are arranged so that the flow of water can be controlled. In front of the front wheels there are two more shower pipes, which serve to loosen the dirt and are manipulated with foot levers. Behind the rear wheels the cleaning roll is situated. This roll is equipped with a spiral of soft rubber and is operated by the same lever that controls the rear shower pipe. The roll is driven by a gear connection to the rear wheels, which is thrown out when the roll is raised. The rear wheels are provided with brakes and a sander.

The battery is mounted in front of the driver and comprises forty cells of 200 amp-hour capacity at the five-hour rate. The charging current varies from 30 amp to 40 amp. To each forward axle there is connected a 4-hp series motor. The controller has five forward points, two braking points and three reverse points. Points 1 and 2 are for

Fig. 2—Electric Street Cleaners in Berlin.

starting, point 3 corresponds to a speed of about 4 miles per hour, point 4 corresponds to about 6 miles per hour and point 5 corresponds to from 8 miles to 10 miles per hour. To control the starting and the battery an ammeter and voltmeter with illuminated scales are provided. Two electric head lamps and a horn with a treadle bellows complete the equipment. The weight of the cleaner empty is about 4 tons.

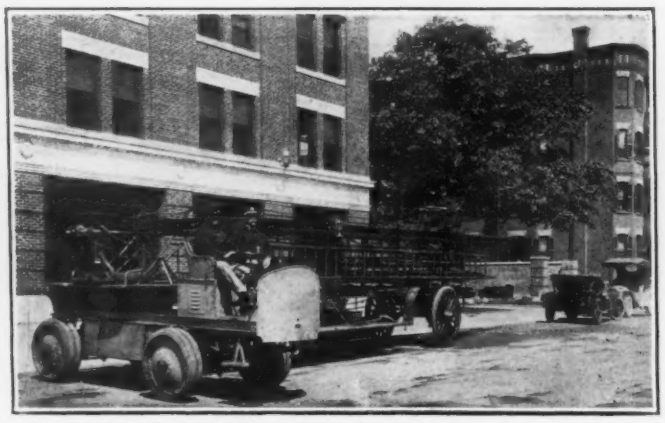
One of these machines will cover 20 miles to 25 miles per day, which corresponds to approximately 500,000 sq. ft. of pavement for nine hours' working time. Although the speed of the electrically propelled cleaner is only 10 per cent greater than that of the horse-drawn cleaner, it is capable of doing much more useful work because of its ability to carry more water, its greater movability and flexibility of manipulation in heavy traffic, its quick turning and high speed when empty. On account of all these advantages the electric cleaner accomplishes more than 50 per cent more work than a similar horse-drawn cleaner.

Energy for charging costs from 3 cents to 4 cents per kw-hour, the charging being done in two stations owned by the city. A cleaner working on nine-hour schedule requires from 15 kw-hours to 20 kw-hours per day, at a cost of from 50 cents to 75 cents per day. The battery upkeep is fixed at a yearly expense of $150 paid to the makers, who make all repairs.

Assuming a day's work to cover 500,000 sq. ft. of pavement and 250 working days per year, the yearly operation and maintenance charges amount to about $800, against about $1,500 for a horse-drawn cleaner that will also cover the same area of pavement per day. This estimate does not include the wear and tear of the purely mechanical parts, such as the rubber brushes, which are the same for both kinds of machine. The saving incident to the substitution of electric motors for horses, assuming the useful work to be the same, is nearly $3 per day. This is more than enough to cover the extra capital charges and yet show a substantial saving. In Berlin, in addition to the ordinary street sprinklers, there are twenty-eight street-cleaning machines in operation, ten being horse-drawn and eighteen electrically driven. The horse-drawn machines will entirely disappear in the next few years and will be replaced by electric machines. Schöneberg, which is adjacent to Berlin, has twelve electric street cleaners. It is proposed in the near future to equip road scrapers for electric propulsion.

ELECTRIC VEHICLES FOR FIRE DEPARTMENT.

In the issue of this paper for July 22, 1911, page 202, an account was given of the pioneer work of the Springfield (Mass.) fire department in the application of electric vehicles to its service. At that time a combination wagon



Electric Ladder Truck.

and 85-ft. aerial extension ladder truck were in service, and the first two months' operation had resulted in a total cost of energy for charging the two machines of less than $11, the rate being 3 cents per kw-hour. It was apparent that even if the life of the batteries should be but a single year

there would still be a margin of nearly 100 per cent in favor of electricity as compared with the cost of service by horses. Two new units have just been added to the service, one being a combination wagon duplicating the earlier installation and the other an 85-ft. extension ladder truck which has been converted from horse to electric driving by the substitution of a couple-gear tractor truck equipped with four 3-hp motors in place of the forward pair of wheels originally used. The tractor has a wheelbase of 7 ft. 6 in., and the current is supplied to the motors from a battery of eighty cells of "National" seventeen-plate storage units hung in the tractor to provide additional adhesion. Solid-rubber tires are used on all wheels, and those on the tractor are double. Tests show that the truck can be turned around in a circle of smaller radius than its over-all length, as indicated in the accompanying photograph. The speed of the truck on a level street is 27 miles per hour maximum, and on a 10 per cent grade a speed of 12 miles per hour has been obtained.

The accompanying photograph was taken in front of the new Court Street headquarters building, in which all the apparatus is of the motor-vehicle type, there being no provision for horses in the establishment. It is probable that the converted ladder truck and the new combination wagon will be established in a new station of the all-electric type, which is planned for erection on the north side of the city in the Patten Street district.

ELECTRIC FIRE TRUCKS.

Within the last few years there have been conducted in Germany exhaustive experiments on electrically driven fire trucks, the results of which indicate that these are best adapted to service in large cities, while other methods of propulsion, or horses, are best for suburbs and small communities. The electric truck is superior with regard to the following points: Readiness for action; cost of operation and maintenance; simplicity of operation; cleanliness; absence of noise and odor. Electric fire trucks are used in Berlin, Charlottenburg, Schöneberg, Rixdorf, Bramschweig, Elberfeld, Duisburg, Hanover, Crefeld, Bremen, Cologne, Frankfort, Dortmund, Magdeburg, Mannheim, Düsseldorf, Schwerin, Wilhelmshaven, Munich, Hamburg and Münster, all in Germany. They are also used in Vienna, Basle, Amsterdam and London. Berlin leads with forty trucks and Vienna is next with twenty-eight trucks.

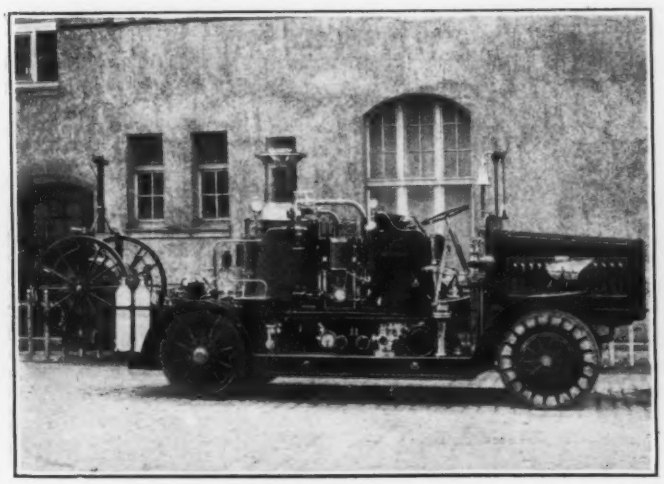


Fig. 1—Electric Fire Engine.

The above-mentioned experiments were carried out upon the truck described below. These tests were reported by Fire Chief Reichel.

The Berlin trucks (Fig. 1), which are built by the Daimler Motoren Gesellschaft, are equipped with motors built into the hubs of the front wheels (Sohner-Porsche or Mercedes-Electrique system). At present the Berlin Fire Department has six complete outfits, each made up of four trucks, and within the next year three more outfits will be added to these. Ultimately it is planned to have 145 auto trucks, 80 electrics, 21 steam and 44 benzine. Each fire outfit comprises one supply truck, one gas blower, one steam blower and one ladder truck, the whole being manned with twenty-four men.

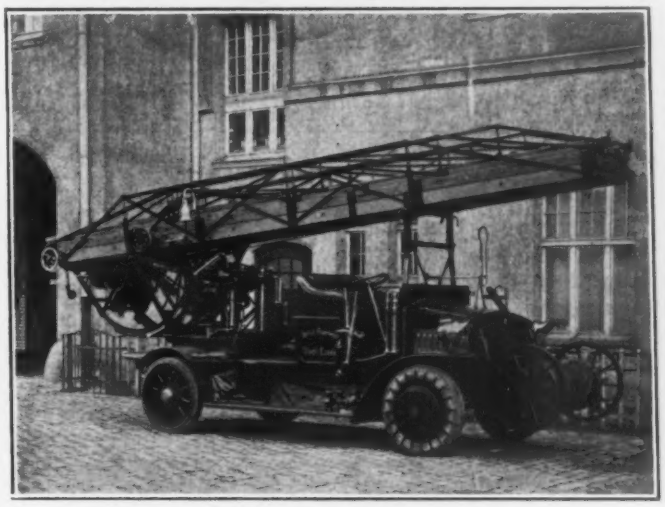


Fig. 2—Electric Hose Truck.

The motors are waterproof and dustproof and are rated at 15 hp, 225 r.p.m. and 160 volts. They are series motors arranged for series-parallel control, which gives five running speeds by dividing the battery. The working weight of the loaded truck is between 4.5 tons and 6.1 tons, and its speed on the level is respectively 25 miles and 22 miles per hour.

The battery consists of eighty-four Tudor cells and has a discharge capacity of from 117 amp-hours to 146 amp-hours and a charge emf of 220 volts. It is carried in four trays placed under a hood in front of the driver's seat and occupies a space 3.5 ft. by 5 ft. The weight is approximately 1800 lb. The working weight of the wagon varies from 5 tons to 6 tons.

The wheels of the truck are equipped with rubber tires 34 in. in diameter and 4.2 in. tread. The truck is provided with an electric and two mechanical brakes, which are independently operated by foot and hand levers and grip cast-steel rims in the hind wheels.

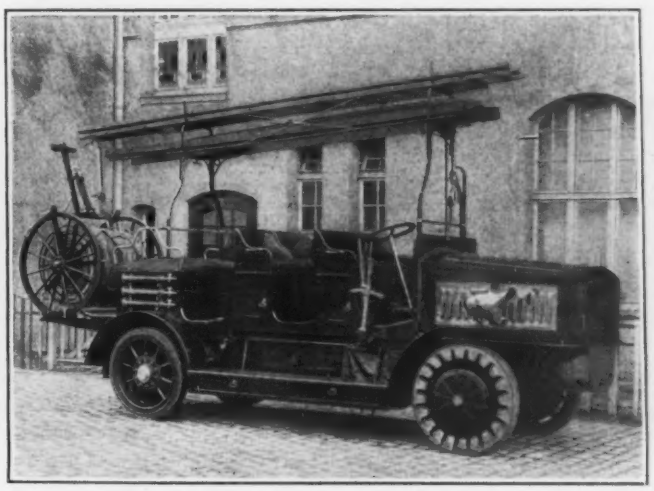


Fig. 3—Electric Ladder Truck.

On level pavement and at 15 miles per hour the energy

consumption of these trucks is 45 watt-hours per ton-kilometer. At this speed the truck can run 40 miles to 45 miles with a single charge. This is the ideal radius of action. However, because of using various speeds, acceleration resistance, etc., the actual radius of action is reduced about 15 or 20 per cent, so that with an average speed of 20 miles per hour a radius of 30 miles can be surely counted upon.

The initial cost of the complete outfit, consisting of four trucks such as used by the Berlin Fire Department, was $36,000. Fig. 3 shows one of these trucks which is used in Essen.

Central Station
Management, Policies and Commercial Methods

BINGHAMTON (N. Y.) INDUSTRIAL EXHIBITION.

That public-service companies best serve their own interests when they serve those of their clients was practically demonstrated in Thanksgiving week, when the Binghamton (N. Y.) Chamber of Commerce held an industrial exhibition. Both the gas and the electric light company engaged booths and with elaborate displays illustrated the new and best appliances for industrial and residential use. In this manner not only did the companies receive actual benefit in an advertising way but they added materially to the good feeling existing between them and the business men of the community, especially as both companies went to large expense and much labor in suggesting and providing show features and lighting facilities in addition to those in their own booths. As remarked by one of the officers of the Chamber of Commerce, this is another illustration of the principle that the better you know a man or corporation the better you like him.

BALTIMORE CENTRAL-STATION SHOWROOM.

"The House Electric" is the name of new showrooms recently opened by the Consolidated Gas, Electric Light & Power Company of Baltimore. The store, which is one of the most artistic in the city, is located at 325 North Charles Street, in the heart of the fashionable center of the city. A handsome display of fixtures is made, as well as everything for the comfort of the lady who is downtown on her holiday shopping expedition. Tea is served in one of the luxurious rooms, and there are a writing-room with telephone conveniences and other well-fitted rooms in which ladies may lounge and chat with their friends. An experienced maid is in constant attendance. An electric kitchen is a feature of the new store. Mr. Robertson, who was formerly with the Electrical Installation Company and who now has charge of the house and store-wiring department for the Consolidated company, is in charge of this innovation. The company will also establish a branch office at which bills may be paid.

RELATIVE ACCURACIES OF GAS AND ELECTRIC METERS.

The 1910 annual report of the Public Service Commission of the First District, New York, contains valuable data showing the relative accuracies of gas and electric meters. In the case of gas meters tested on complaint the law permits an error of 2 per cent, and an error of 4 per cent is allowed on electric meters. The year 1910 showed an increase over the previous year in the number of applications received for tests of gas meters and a decrease in the number of applications received for tests of electric meters, which is attributed to the frequent inspection and calibration of meters by the electric-lighting companies. The records of the commission show that of the 4428 gas meters tested by it upon complaint of customers, 2220, or almost exactly 50 per cent, were over 2 per cent fast, and 398, or 9 per cent, were over 2 per cent slow. In the case of electric meters, of the 637 meters tested on complaint, thirty-six, or less than 6 per cent, were over the error allowed by law and forty-seven, or approximately 7.5 per cent, were over 4 per cent slow.

LOUISVILLE "WHITE WAY."

Business men on Market Street, between First and Seventh Streets, in Louisville, Ky., celebrated the opening of the "Long White Way," as it was termed, on Dec. 1 by a parade with bands, burning red fire, giving away thousands of more or less valuable souvenirs and the purchase of scores of pages of newspaper space. Turning current on the lamps of the ornamental iron standards, each surmounted by five opalescent globes and ranged in boulevard effect along both sides of the thoroughfare, marked the most aggressive campaign of the merchants of that part of the Kentucky metropolis in a long while.

Market Street is one of the two principal retail thoroughfares, Fourth Avenue being the other. The latter is considered the more fashionable section, and the trend of trade has been south on Fourth and away from Market Street. Merchants in that part of the city decided that bright lights were the best weapon they could use to fight the competition of Fourth Avenue, and they therefore arranged for the installation of Federal standards, electricity being supplied by the Louisville Lighting Company and the Kentucky Electric Company.

The success of the idea is illustrated by the fact that 10,000 people turned out on the night of the opening and thronged the street for hours during the celebration.

GAS CONSUMPTION IN LAWRENCEVILLE (ILL.) PLANT.

The Lawrenceville Light & Water Company, of Lawrenceville, Ill., operates a combined steam and gas-engine plant, giving electric and water service, all of the fuel being natural gas from the Lawrence County fields. Gas engines are used for the greater part of the output, but steam is maintained in one boiler continuously to be ready for operating a steam pump in case of a fire alarm. A steam-engine-driven generator is also employed as a reserve in the plant for use when gas engines are being overhauled. The outputs of the various generators in the plant for the six months ended Oct. 1, 1911, were as follows, all of the generators being belt-driven:

50-kw gas-engine-driven generator	55,600 kw-hours
75-kw steam-driven generator	7,400 kw-hours
110-kw gas-engine-driven generator	152,800 kw-hours
Total output for six months	215,800 kw-hours

The consumption of gas for all purposes, including keep-

ing up steam and some steam water pumping, amounted to 42.4 cu. ft. per kw-hour of output.

A test made on the 150-hp Nash gas engine, with a load of 39.6 kw, constant, showed a consumption of gas on a five-minute run of 28.6 cu. ft. per kw-hour. The gas consumption was in each case reduced to what it would be at 4-oz. pressure, and the meters used were the regular watt-hour and gas meters through which the input and output are measured. The figures make no claim to extreme accuracy, but show commercial conditions as they exist in this particular small plant.

OBSOLESCENCE OF THE HORSE.

The illustration shown herewith accompanied a recent newspaper advertisement of the Boston Edison company, which included data indicating the great progress of the electric vehicle. Among the statements were that a St. Paul baking company had just ordered twenty electric wagons, and that nearly on the same day the American Express Company bought fifty electric wagons and immediately ordered fifty more from another maker. It is pointed out that the largest power-truck factory in the country makes electric trucks exclusively, and that the largest manufacturer of gasoline automobiles has recently begun making electric trucks. It is stated that in and around Boston there are now sixty public electric-vehicle charging stations and nearly 300 private charging plants, and that, whereas last January there were only two electric commercial and four passenger vehicles represented in Boston, the representation now includes sixteen commercial and passenger vehicles, while six other makers are negotiating for quarters.

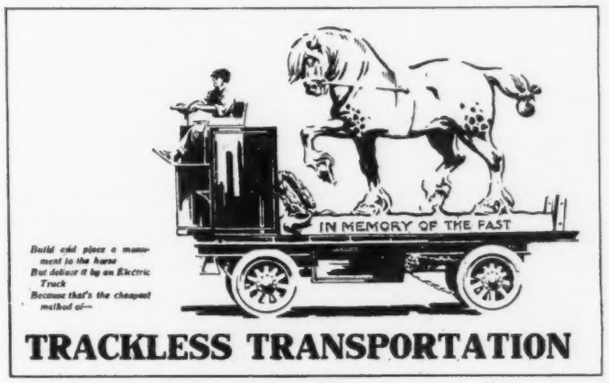

IN MEMORY OF THE FAST
Build old plugs a monument to the horse
But deliver it by an Electric Truck
Because that's the cheapest method of—
TRACKLESS TRANSPORTATION

Illustration Accompanying a Newspaper Advertisement.

MEETING COMPLAINTS OF HIGH ELECTRIC-LIGHT BILLS IN THE MONTHS WITH LONG NIGHTS.

Every central-station operator is familiar with the fact that consumers, especially residence owners, are prone to complain of "mistakes in the lighting bill" when it is rendered in the autumn and winter months. The householder who has been paying $5 a month for light during the summer will immediately assert that he is being mistreated if his November bill amounts to $8. Just how to get rid of the multiplicity of complaints arising from the human failing of not taking changing conditions into account has been a matter of much thought among central-station men.

The Nashville (Tenn.) Railway & Light Company has been experiencing trouble along this line, and finally it decided to explain the whole situation in detail. A quarter page of advertising space in the Nashville dailies was purchased, and the company headed its announcement "Why Your Light Bill Is Higher at This Season of the Year." Then the following statement was made: "The days are getting shorter, the nights longer; the daylight hours are short, the electric-light hours long. The table given below gives the dark hours every month during the year. Study it carefully. It will explain to you why your light bill is higher in winter than in summer."

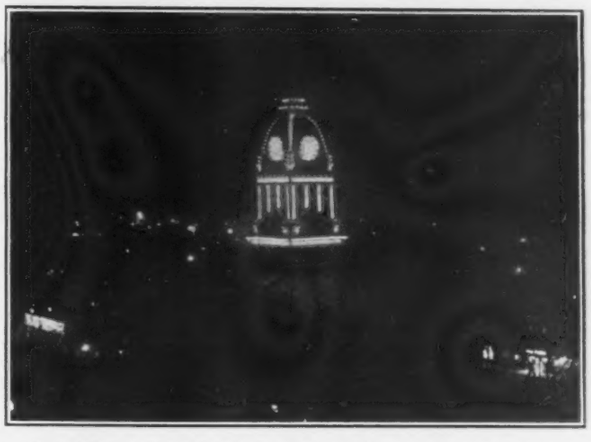
Following the presentation of the table an explanation of it was presented as follows:

"A 16-cp lamp costs two-thirds of a cent an hour to burn. If you burn one 16-cp lamp from dusk until 10 o'clock every night throughout the year it will burn 38 hours in June and 204 hours in December. At two-thirds of a cent an hour per lamp you would use 25⅓ cents' worth in June and $1.36 in December. You are getting the same amount of light for your money in each case, but in the winter you use electric light more hours. If you keep a store and close up every night at 6 o'clock in the summer you need no light whatever; but in December there are eighty hours from dusk until 6 o'clock, and it will cost you 53⅓ cents per lamp for the eighty hours. Whenever you think that your electric-light bills are too high, *we want you to tell us about it—but kindly take the above into consideration in contrasting your winter and summer bills.*"

It may seem to some absurdly superfluous to explain to the consumer that the longer he burns his lamps the more electricity he is going to consume, but the experience of many central-station companies shows that an explanation to that effect will meet a complaint satisfactorily, whereas silence would only increase the irritation.

CENTRAL-STATION PROGRESS AT NEWARK, OHIO.

Electrical progress in the city of Newark, Ohio, has been rapid since the advent of central-station service in the commercial lighting field, succeeding the former municipal lighting circuits. Newark is a bustling factory town of 28,000 population, and is also the site of the factory of one of the large illuminating-glassware manufacturers. The Licking Light & Power Company, composed of local capitalists, had prosecuted a number of active central-station campaigns to secure the general household use of electricity for sewing-machine motors, heating and cooking appliances, vacuum cleaners, etc., but recently sold its plant to the American Gas & Electric Company, which has followed up the aggressive policy of making Newark a city of bright lights. One of the striking evidences of this campaign is the outline lighting of the Licking County court house, shown in the accompanying illustration. The



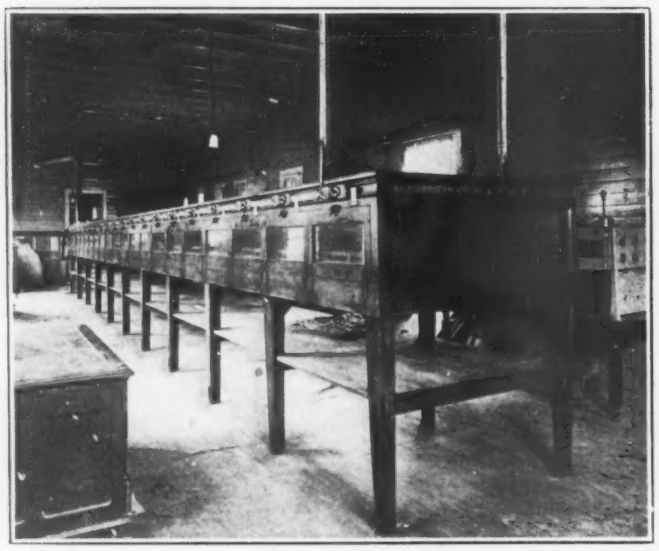
Outlining of Licking County Court House, Newark, Ohio.

principal architectural features of the spire are marked by rows of incandescent units, while the dials of the clock are similarly illuminated.

To meet the rapid increase in the demand for the company's service in the way of both lighting and electric power a number of important improvements are being made at the former Licking plant, which is now operated by the American Gas & Electric Company. A new 180-kw generator is being installed, and a modern switchboard capable of controlling about twice the present equipment of the station is being put in place. Poles and wires are being removed from the streets, to be replaced by circuits following the alleys. The efforts of the company in thus promoting the civic welfare of Newark are meeting with much appreciation from the members of the local Board of Trade and other citizens. Mr. George N. Tidd is vice-president and general manager of the holding company, Mr. H. L. Montgomery manager of the local company and Mr. Fred Morrison assistant manager.

A 6000-EGG ELECTRIC INCUBATOR.

The New Orleans Railway & Light Company has about sixty domestic-size electric incubators in use on its lines, besides several very large commercial equipments. The largest electric incubator in service in New Orleans, if not the largest anywhere, is a 6000-egg outfit recently built by the local Electric Manufacturing Company for Mr. A. Willoz, a professional poultry raiser. This incubator is 40 ft. long and 5 ft. wide, and contains forty separate compartments, each having a capacity of 150 eggs. Each compartment can be separately controlled so that all or any parts of the incubator can be operated, according to the number of eggs to be hatched. The controlling thermostats used do not completely break the heater circuit but introduce the comparatively high resistance of a small electric lamp when open. This avoids sparking at the contacts, while the flickering of the lamp makes easy the close



A 6000-Egg Electric Incubator.

adjustment of the thermostat. The maximum demand of the heater in each compartment is 60 watts, and the minimum, with the resistance in series, 7 watts, the average throughout the hatch ranging from 20 watts to 25 watts. The average consumption of energy is 10 kw-hours to 12 kw-hours per compartment per hatch, the cost of operating the incubator at the rate afforded by the New Orleans company being about 50 cents per compartment per hatch. Mr. Willoz, the owner, is reported to be very much pleased with the successful operation of his large electric incubator, which has now been in service six months. He formerly used both oil-heated and gas-heated incubators, but declares that under no conditions would he return to these types of heaters.

As already noted in these columns, June 8, Mr. W. E. Clement, contracting agent for the lighting company, believes that electric incubators make a specially desirable central-station load on account of their long-hour characteristic. A large window of the company's office has been given over to an electric incubator in process of hatching a number of eggs, and the chickens produced will be brooded in an electrically heated hover.

CUSTOMERS' PANELS FOR LIMITED-PEAK SERVICE AT MILWAUKEE.

Under the new rate schedule of The Milwaukee Electric Railway & Light Company customers who agree to keep off its lines during peak periods or to use limited demands during these times secure a substantial decrease in the cost of their electrical energy, amounting to a reduction of one-half the "demand" element of the charge.

For controlling the service of such limited-service customers Mr. O. M. Rau, electrical engineer of the company, has recently designed and had built special panels equipped with time-clocks and circuit-breakers, which are installed by the company at the expense of customers contracting for such limited service.

The panels used by the Milwaukee company provide for the three conditions of (1) limited demand in kilowatts, (2) peak-period disconnection of service with limited demand at other hours, and (3) two distinct and adjustable

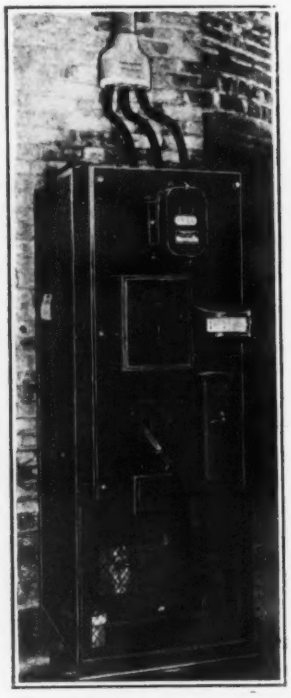


Fig. 1—Customer's Panel for Limited Peak and Off-Peak Service.

demand limits, for service during peak period and off-peak periods respectively. Each panel is equipped with a watt-hour meter which is furnished free by the company. The rest of the equipment, oil switch, relay, time-clock and panel, is furnished at the customer's expense (costing $100 to $200 each), but is entirely subject to the settings and supervision of the company's inspectors. The time-switch settings are corrected from month to month by these inspectors, to follow the time of peak load.

The simplest type of panel, as above noted, comprises

an oil switch with overload coils, causing the breaker to trip out at a demand above that contracted for. The second type, or peak-period cut-out panel, has a time-switch which during the hours of peak load completes the circuit to a shunt tripping coil, thus opening the oil switch and preventing its closure again during the peak period.

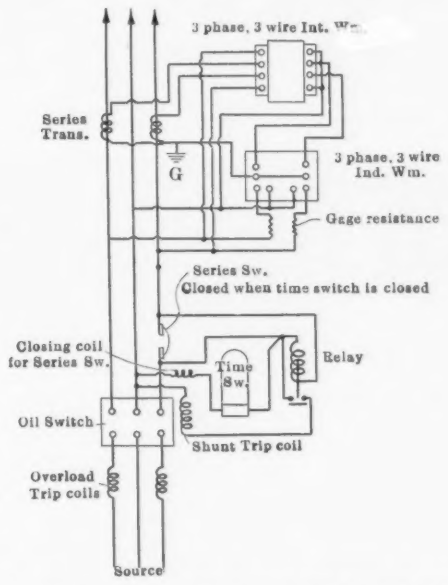


Fig. 2—Circuits for Limited Peak and Off-Peak Service Panel.

At the end of this time the handle can be thrown in as usual.

The accompanying photograph and sketch show the limited-peak panel. This provides one demand limit for off-peak hours and a lower limit during the peak. The series overload trip coils effect the high-limit opening. During the peak hours the time-switch completes the circuit to the shunt trip coil, which, however, includes the contacts of the adjustable relay shown. The operation of this relay, occurring when the time switch is closed, thus completes the shunt-coil circuit of the main oil switch, opening this switch and preventing its closure during the peak period. The customer may thus contract to use a certain limited demand during off-peak hours, obtaining a smaller amount of energy during the peak, for which he pays accordingly. A number of these panels have been put in service at Milwaukee.

ISOLATED-PLANT COSTS WHICH AN OWNER MAY OVERLOOK.

A large textile-mill owner about to equip a new factory was investigating the comparative expense of mechanical drive from a gas-engine plant and of motor operation using central-station drive. He found that the cost of the number of small motors required would be $8,000, while a gas engine of equivalent rating was quoted to him for $500. With a ratio of 16 to 1 thus in favor of the isolated plant there seemed no possible doubt of the kind of power to use, and the central-station solicitor was waved aside with a smile. The latter, however, soon got busy with his data on the cost of shafting, pulleys and belts, and returned to the mill man's office with figures to show that the cost of the mechanical transmission apparatus would in reality bring the total expense of gas-engine drive up to that of individual motor drive. Moreover, the loss of energy occasioned by the friction of the shafts, belts, etc., would represent a continual cost of $1,700 a year, which electric drive would save.

In general, the point was also made by the solicitor that the power cost here, as in many other businesses, actually amounted to only 3 to 4 per cent of the total manufacturing cost. Even if some other means of drive showed a saving of a few dollars on the hundred the proportional economy on the whole cost of production would be slight. And such a petty saving should be investigated for its effect on the other elements of production cost, such as convenience, comfort, simplicity, flexibility, reliability, etc. If it were found, for example, that motor drive cost a few per cent more than isolated-plant mechanical drive (though amounting only to a fraction of a per cent difference in the total manufacturing cost) the mill owner should consider whether such evils as the lack of reliability of a balky gas engine which might be shut down for repairs Tuesday and Thursday, the darkened rooms filled with overhead belts and shafts, the labor and time lost in routing goods according to the arrangement imposed by the mechanical drive, and the many other attendants of isolated service, might not, after all, contribute much more to the debit side of the ledger than the possible slight extra cost of modern drive.

Wiring and Illumination

UNIFORM DESIGN OF STREET-LIGHTING STANDARDS.

In view of the fact that the Sanitary District is preparing to install 10,000 additional arc lamps for street lighting in Chicago, the City Council of that city directed the Mayor to appoint a committee of aldermen, city officials and citizens, whose duty it should be to establish a uniform design of post, globe, etc., to which the new standards and all future city street-lighting installations shall conform. It is encouraging to note that the Chicago Plan Commission, which is moving slowly toward a more beautiful city, is represented on the committee. The Mayor has announced a committee of fifteen to select the design. The committee consists of Alderman Joseph F. Ryan, chairman; Aldermen Twigg, Brennan, Foell, Capitain, Utpatel and Janovsky; Messrs. W. D. Kerfoot, Henry E. Coonley and William Holabird, for the Chicago Plan Commission; Messrs. E. U. Kimbark, Edward M. Skinner and George Beaumont, for the Chicago Association of Commerce; Mr. William Carroll, city electrician, and Mr. E. B. Ellicott, electrical engineer of the Sanitary District.

THE ILLUMINATION OF TEXTILE MILLS.

The artificial lighting of textile mills is in fact a special field of engineering and one which offers great room for improvement, according to Mr. Frank W. Reynolds, who presented a paper on the general subject of mill engineering at the recent convention of the American Society of Mechanical Engineers in New York.

While electric lighting is now generally adopted, there are, said the speaker, many mills where gas lighting is still used and a few where the old oil lamp may be found. A white light is the best for all purposes, but with many forms of the incandescent bulb the light actually obtained is quite yellow. On all white work the Cooper Hewitt lamp has been used with very good results, since it is steady and gives a powerful illumination. It has been found very serviceable in machine shops, and it has the virtue of allowing one to concentrate his gaze without undue fatigue of the eyes. In cotton mills, however, the operatives generally prefer local to general lighting, but this involves many difficulties in securing the right arrangement of the different lamps. The placing of a hooded bulb close to that part of

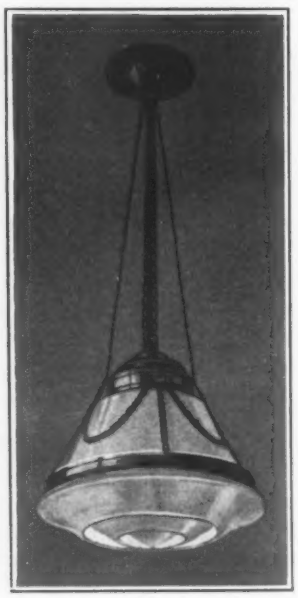
the machine which the operative must keep under his eye has been one solution of the difficulty of cross shadows which arises when a series of lamps are placed near a row of machines. This hooded local light, which seems at first sight desirable, probably tends to provoke accidents, owing to the deep shadow surrounding the machines. The alternation of the operative's gaze between the brilliantly lighted patch of his machine and the comparative darkness which surrounds that lighted patch has also been found to be hard on the eyes. This would seem inevitable, because a quick glance from a brightly lighted spot to a dark spot and then back again to the light spot involves two very rapid accommodations of the eye mechanism and a consequent excessive strain.

APPLICATION OF DIFFUSION TO ELIMINATE GLARE.

The accompanying illustration shows an unusual diffusing reflector recently developed in Switzerland under the patents of Ritter and Uhlmann, of Basle. Several installations of the system have been made in the industrial school of that city, where use is made of the new reflectors in the illumination of both exhibition rooms and auditoriums.

In principle this reflector insures that no direct rays from the filament shall leave the fixture without coming from one or the other of the supplementary diffusing surfaces, either the etched translucent glass or the matt reflector within. The lower globe, as shown, is made up of concentric, truncated-cone surfaces, alternately erect and inverted. The inwardly sloping surfaces of the inverted cones are lightly etched with acid. The outwardly sloping surfaces of the erect cones are of clear glass.

Direct rays of the filament thus pass through the inwardly sloping cone surfaces of the globe, which are lightly acid-etched so as completely to hide the light source. While this translucent surface hides the image of the filament, it is not dense enough to affect the efficiency greatly. Rays leaving the filament in the upper hemisphere strike a parabolic reflector surface of porcelain or matt aluminum. From this they are reflected back downward and

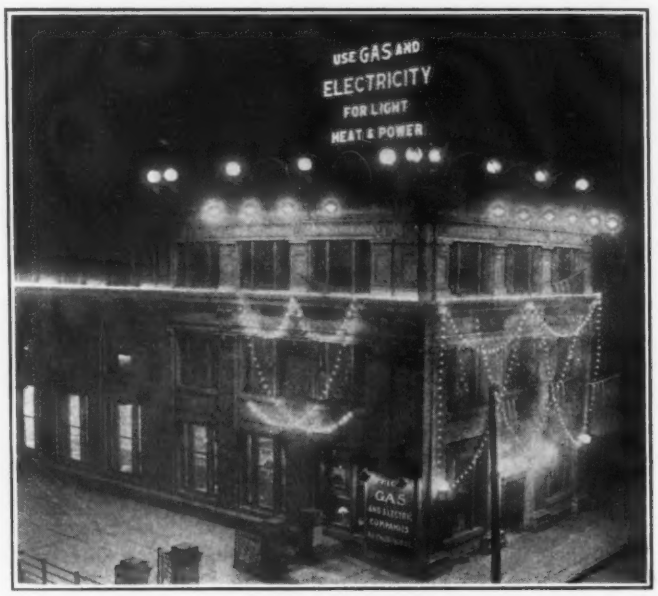


Improved Diffusing Fixture for Incandescent Units.

pass out through the outwardly sloping cone surfaces of the glass, which are clear. A maximum outlet for the whole spherical flux is thus provided through the lower surface, most of the light undergoing only a single diffusion. This, in addition to the very light acid etching or frosting of the translucent surfaces, contributes to the unusual efficiency reported with these new units. From no point beneath the fixture can the filament itself be seen through the clear glass surfaces.

DECORATIVE LIGHTING AT LOUISVILLE.

Upon the recent occasion of the visit of President Taft to Louisville, Ky., the Louisville Lighting Company paid a tribute to the head of the nation by means of a notable blaze of illumination surrounding its building. Incidentally



Building of Louisville Lighting Company, Louisville, Ky.

the display demonstrated to the public the quality and advertising value of three kinds of lighting—electrical, gas and electrical reflected. The lighting company is associated with the Louisville Gas Company.

The handsome three-story building which is the headquarters of the lighting company at 311 West Chestnut Street was draped with incandescent lamps extending up to the third story. The blazing strands formed United States shields, although the stars and stripes were lacking from the general outline. The upper cornice of the building was ornamented with ten upright electric globes of opalescent glass, illuminated from within by a 150-watt tungsten.

There were also ten pendent gas arcs along the upper edge of the wall, and a border of 25-watt tungstens fringed the cornice between the second and third floors. Two polished reflectors equipped with high-powered electric illuminants lighted up the sign of the company on the first-floor wall near the pavement.

RECENT TELEPHONE PATENTS.

RINGING SYSTEMS.

The harmonic type of selective ringing system is now pretty well established, and although there are a number of different systems, all of these follow the same general practice. The frequencies generally adopted are 16, 33, 50 and 66. As a fact, however, even these frequencies are only approximate, since as practically produced they must bear a definite fractional relation to each other, all being obtained from a single generator. The exact frequencies are thus proportional to the series 1, 2, 3 and 4; that is, two are in the ratio of the octave and two in the ratio of the fifth of the harmonic scale. This results in a marked tendency to interference, because of the overtone relation.

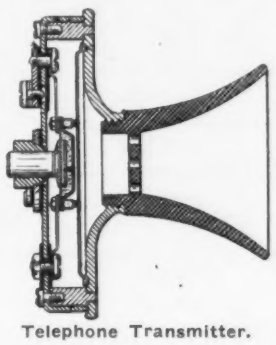
To overcome this tendency Mr. C. H. North, of Cleveland, Ohio, has produced a system in which the frequencies are chosen in the ratio of 5, 7, 9 and 11, or, more definitely, 30, 42, 54 and 66. The patent is assigned by him to the North Electric Company.

A ringing pole-changer forms the subject of a patent granted to Mr. H. N. Faris, of Kansas City, Kan. The vibrator is arranged to run continuously, obtaining its energy from a special battery. The main or ringing battery has its circuit open while connected to the vibrator and to the primary of a ringing transformer, until demand is made for ringing current. When this demand occurs the primary circuit is closed through the action of a relay. The secondary circuit then responds and this condition is maintained as long as the ringing current is required.

Messrs. E. Stout and J. S. Kupka, of Martinsburg, Ia., have patented a selective party-line system. Currents produced by hand generators at each station serve to control the action of clockwork switching mechanism, which runs synchronously at all of the stations. Arrangements are provided for signaling any or all of the stations as desired, as well as for setting back any motor which has got out of step.

TRANSMITTER.

Herewith is shown in section a transmitter patented by Mr. C. T. Mason, of Sumter, S. C., and assigned to the



Telephone Transmitter.

Sumter Telephone Manufacturing Company. The inside of the transmitter is shielded from moisture by a plate which incloses the back, while the rim of the diaphragm fits into a groove on the back of the face plate. In order to avoid electrolytic action the circuit is not led into the diaphragm, as is customary.

LETTERS TO THE EDITOR.

A Suggestion Concerning the Wireless Distress Signal.

To the Editor of Electrical World:

SIR:—Most of the ships now supplied with wireless apparatus carry but one operator. For this reason the apparatus is ready for receiving distress calls during only a portion of the time. It would therefore seem desirable that the distress call be so simplified as to be recognized without question by persons not acquainted with the telegraph code. If this were done, it would be possible for the captain of the ship to detail some one to wear the telephones while the operator is off duty. Of course, as soon as the distress signal was heard the operator would be called and communication established. The letter "S," which is the same in both Morse and Continental codes, consisting of three dots, would, in some definite combination, be a suitable distress call. For instance, "S S S" might replace the present "S O S" if the coming International Wireless Conference in London could be persuaded to make the change. This repeated a large number of times could hardly fail to be distinguished by even the most inexperienced.

Under the present conditions I believe it is often customary for the wireless operator to be off duty from midnight to morning, which is the period during which a large portion of the accidents take place. Any change which can make it possible to have every ship constantly ready to receive distress calls must vastly increase the usefulness of this safety device.

LOUIS W. AUSTIN.

United States Naval Radio-Telegraphic Laboratory, Washington, D. C.

Office Buildings as Summer Central-Station Load.

To the Editor of Electrical World:

SIR:—In all of our large cities a most active struggle exists between central-station service and isolated electric plants for large office and mercantile buildings. There are some inherent reasons why office-building load is difficult for the central station to secure in some cases. The chief of these is the necessity of low-pressure steam for heating purposes during six months of the year or more, depending on the latitude. As this exhaust steam can be supplied through an electric-lighting engine acting as a reducing valve, with practically the same coal consumption as through any other reducing valve, the central station is "up against" the argument that during heating months the cost of coal for the isolated electric plant can be figured as zero.

Of course, this is only one side of the argument. Against the isolated plant is the necessity of operating in the summer during long periods of light load at very poor economy with no use for the exhaust steam. The same general arguments apply to the use of electric elevators supplied from central-station service as against hydraulic elevators with steam pumps exhausting into the heating system. There is an undoubted economy during the winter months and lack of it during the summer with the latter.

Another factor which has considerable influence is the policy of the building owner as to the supply of electric light. In far too many buildings it is supplied at a flat rate along with the rent. This practice gives rise to the usual dissatisfaction which accompanies flat rates and inevitably results in considerable waste, which the building owner makes up for by corresponding additions to the rent. Some building owners have come to realize that this practice is a handicap to them in renting space in competition with other office buildings where lighting service is furnished on a meter and costs the tenant considerably less than the additional rent for flat rate which he would pay under the other system. As a result some of the owners who formerly furnished electric light either with the rent or on a flat rate per lamp per month have installed meters and sell electrical energy to tenants on the same basis as if it were supplied by a central-station company. When the flat-rate waste is stopped the amount of exhaust steam obtainable from the electric-lighting service is, of course, much reduced. The lighting becomes more of a peak-load proposition and less valuable for supplying exhaust steam.

A logical method of handling this class of business which has been tried in some cities is to carry this office-building load on the building's own electric plant during the steam-heating season and turn it over to the central-station company during the summer months. In this way the central station obtains load to fill in the summer valleys of its load curve and the office-building owner is saved a lot of uneconomical operation when he has no use for exhaust steam.

Such a practice will, undoubtedly, increase in the future. At present it is in somewhat the same state as the securing of off-peak power business five years ago. A few central-station companies were carrying this kind of business and

improving their returns on their investment by it, but the majority thought it impracticable.

The main obstacle in the way of carrying summer business of office buildings on central-station service and turning it back to the isolated plants in the winter is the prejudice which some central stations have not outgrown against having anything whatever to do with isolated plants, in the fear that an isolated plant once installed will take the business for the whole year and thus cause a greater loss of revenue than if the isolated plants were kept out altogether. Nevertheless, off-peak business requiring but little additional investment to secure summer load and improve the yearly load factor seems more to be desired under the present state of central-station finances than carrying the modern office building through the winter peak. To be sure, the office-building peak does not coincide with the residence-lighting peaks in our large cities, but it is nevertheless a most important factor in the peak of the entire system. The central-station company which is seeking to increase the net returns per dollar invested will naturally seek the character of load which will most improve its load factor, and some improvement of this kind is to be found in purely summer load.

Boston, Mass. CHAS. L. DUTTON.

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

Synchronous Machines for Automatic Voltage and Current Regulation.—ROBERT MOSER.—After a general introduction on some principles of voltage and current regulation of separately excited machines the author discusses first the synchronous machine shown in Fig. 1, in which 1

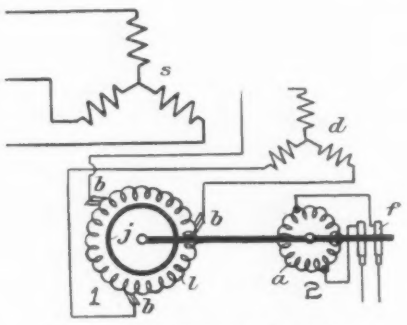


Fig. 1—Synchronous Regulator.

is the main machine (*s* being the stator and *l* the rotor in the form of a direct-current armature with commutator and three brushes *b*) and 2 is the exciter (*d* being the stator and *a* the rotor with distributed winding which is supplied with direct current through the slip rings *f*). The main machine 1 and the exciter 2 are coupled together. The stator *d* of the exciter is connected to the brushes *b* of the main machine. Exactly synchronous three-phase currents are, therefore, supplied to the rotor *l* and produce in it a magnetic field rotating exactly in synchronism, so that the rotor winding *l* behaves like a non-inductive resistance toward the polyphase current in it. By properly arranging a damping winding *j* (which is discussed in some detail) the commutation of the machine can be improved. By a

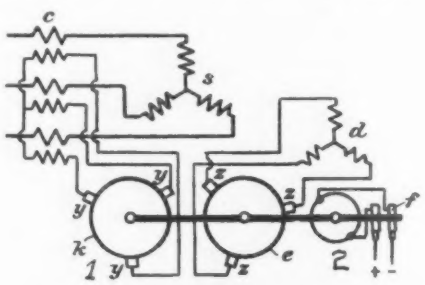


Fig. 2—Constant-Voltage Regulator.

simple modification this machine can be made to yield constant voltage. For this purpose the rotor of the main machine 1 in Fig. 2 is provided with two direct-current armature windings *k* and *e* with their commutators. The winding *e* with the brushes *z* corresponds exactly to the winding *l* and the brushes *b* in Fig. 1. On the other hand, the winding *k* is supplied through the brushes *y* with three-phase currents from the secondary of the transformer *c*, the primary of which is the series with the stator winding *s*. In this way not only are the ampere-turns of the rotor of the main machine due to the current from the separate exciter, but there are additional ampere-turns derived from the current in the stator *s*. By properly selecting the transformation ratio of the transformer *c* and the position of the brushes it is possible to insure that the machine will

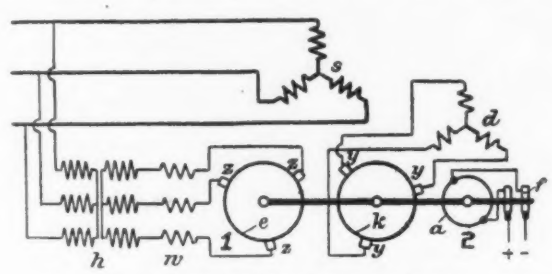


Fig. 3—Constant-Current Regulator.

give constant voltage at any load and any power-factor. The author describes how by one single experiment the proper transformation ratio and brush position may be determined. With proper precautions it is possible to use one single armature winding in the main machine 1 instead of two windings, as shown in Fig. 2. It is also possible to modify the arrangement for single-phase current, as is described in some detail by the author. A constant-current machine is simply a reversal of the constant-voltage machine, in that voltage is substituted for current and current for voltage. Fig. 3 shows a constant-current machine; the whole difference from Fig. 2 is in the arrangement and connection of the transformer *h*, which supplies the addi-

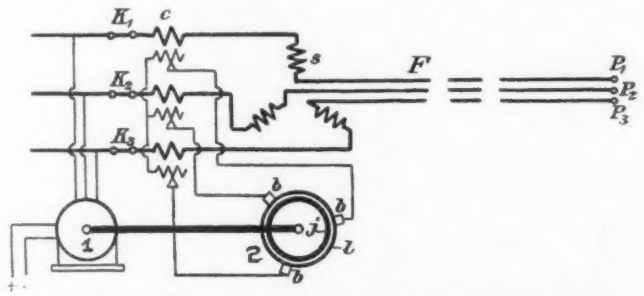


Fig. 4—Regulator Compounded for Line Drop.

tional ampere-turns to the rotor of the main machine. Finally it is possible to use the same principle for the construction of a booster which compensates the voltage drop in a long line, as shown in Fig. 4. *F* is a long transmission line, at the beginning of which (K_1 K_2 K_3) the voltage is maintained constant by some means. The problem is to

maintain at the other end (P_1 P_2 P_3) also constant voltage for any load and any power-factor. To solve this problem the stator *s* of a booster 2 quite similar to those described before is connected in series with this line. The rotor winding *l* of the booster is supplied through the brushes *b* with a current which is proportional to the current in the line *F*, being taken off the transformer *c*. This machine rotates synchronously, being driven by the synchronous motor 1. By properly adjusting the transformation ratio of the transformer and the position of the brushes it can be accomplished that at the end of the line, P_1 P_2 P_3, the voltage is constant and the same as at the beginning, K_1 K_2 K_3. The advantage of all these machines over constant-voltage or constant-current machines with purely separate excitation (Fig. 1) is that in the latter the magnet copper cannot be economically utilized, while this is possible with the arrangements described.—*Elek. Zeit.*, Nov. 9 and 16.

Rectifier for Charging Small Storage Batteries.—In a construction devised by a German company and illustrated in Fig. 5 the alternating current of the supply network *a b* is first transformed by means of the transformer *T* down to a voltage (4 volts to 20 volts) corresponding to the

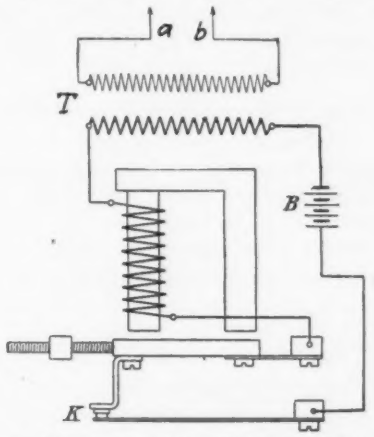


Fig. 5—Diagram of Connections of Rectifier.

number of cells in the battery *B*, and the low-voltage single-phase current is then rectified by means of a vibrating rectifier. To prevent sparks at the contact of the interrupter, the armature must vibrate in synchronism and in time-phase with the alternating current. For this purpose the electromagnet is excited by the pulsating direct current directly. The use of a polarized armature is thereby avoided. Without the use of condensers, etc., the operation of the interrupter is entirely sparkless. The apparatus itself has no definite polarity, but its polarity depends on the connections to the battery *B*. The vibrations of the armature depend on one hand on its mass and on the force of the spring which tears it off, and on the other hand on the magnetic forces which act on it. If now for a given frequency the apparatus is started in such a way that the circuit is closed at the moment in which the alternating emf is opposed to the battery emf, the time-phase of vibrations is definitely settled for this frequency. The apparatus always supplies charging current to the battery, and it does not matter with which polarity the battery is connected to the apparatus. Variations of the frequency by ± 5 per cent have no effect. The fact that the apparatus is independent of the polarity permits its use by laymen. The efficiency of the charging apparatus, including the transformer, is from 40 to 45 per cent, even with very small loads, such as 10 watts.—*Elek. Zeit.*, Nov. 23.

Direct-Current Turbo-Generators.—An account of the lengthy discussion which followed the reading of the paper of Roberts recently abstracted in the *Digest*. The various speakers dealt with a great many different mechanical difficulties in the design and construction of direct-current turbo-generators.—Lond. *Electrician*, Nov. 24.

Lamps and Lighting.

Neon Tubes.—GEORGE CLAUDE.—A paper presented before the International Society of Electricians in Paris. The author first gives a historical sketch of the development of the neon tube lamp and then describes the different steps in the formation of a neon tube as follows: The tube is first filled with very pure neon (obtained from liquid air after separation of oxygen and nitrogen). The current is then passed through the tube while it is evacuated by means of a pump. It is then filled again with neon and evacuated again and this is repeated several times. Any other gases which may be in the tube besides the neon are then condensed by means of charcoal at the temperature of liquid air. The current is passed through the tube continuously during these operations. The tube is then ready for use. At an automobile exhibition in December, 1910, in Paris four tubes 36 m (118 ft.) in length were used for decorative lighting. Photometric tests were made with another tube 6 m (20 ft.) in length and 45 mm (1¾ in.) in diameter, which showed a specific consumption of 0.64 watt per cp. The author estimates that with a greater length of the tube the specific consumption could be reduced to 0.5 watt per cp, the power input being measured at the electrodes, or 0.6 watt per cp if the power is measured at the primary of the transformer. There was one more difficulty to overcome since the first tubes failed after a few hours on account of the absorption of neon by the electrodes. The remedy was found when the observation was made that the metallic deposits formed on the walls of the tubes opposite to the electrodes contained neon. Claude concluded that the absorption of the neon had to do with the volatilization of the electrodes and that if the latter could be overcome the absorption of the neon would stop. This could be done by using large electrodes. With electrodes having a surface of about 5 sq. decimeters (78 sq. in.) per ampere the life of a 5-m (16 ft.) tube is from 800 to 1000 hours. That is, such a tube will last under ordinary conditions for about a year. Under normal operations the tubes of 45 mm (1¾ in.) diameter consume from 0.8 amp to 1 amp and give 200 cp per meter of length. While maintaining a satisfactory efficiency, it is possible to reduce the luminous intensity to one-half by reducing the current in the same proportion. This can be done by adjusting the self-inductance in series with the tube. It is also possible to get a higher luminous intensity, but only at the expense of the length of life, since the electrodes begin to evaporate when the current is pushed above the normal value. The voltage at the terminals of the tube depends on its length. About 1000 volts are required for a tube 5 m (16 ft.) in length. Of these, 350 volts are absorbed in the immediate neighborhood of the electrodes and the rest in the luminous column. Side by side with ordinary lamps the neon tubes seem to give a light somewhat too red, but if used alone the light has a yellow-gold color which is quite agreeable. Claude prefers to use two or three tubes each 5 or 6 m (16 ft. to 20 ft.) in length, in series across the secondary terminals of a transformer with an adjustable self-inductance in the primary circuit. The secondary voltage is from 3000 to 4000. The efficiency may be easily increased by replacing two tubes 6 m (20 ft.) in length by one 13 m (43 ft.) in length. Such a tube in the form of a rectangle with sides 4 m (13 ft.) and 2.5 m (8 ft.) in length was exhibited in the lecture hall of the Society of Electricians. Including the transformer losses the specific consumption was 0.7 watt per cp.—*La Revue Elec.*, Nov. 24.

Train Lighting.—An illustrated description of the Silvertown train-lighting system which is being experimented with at present by one of the large English railway companies. The equipment consists of a generator driven from the car axle and carrying on its shaft a governor for operating the switchgear and a double battery of accumulators, one battery being normally connected to the ter-

minals of the lamp circuit, while the other is connected to the armature terminals for charging.—Lond. *Electrician*, Nov. 24.

Generation, Transmission and Distribution.

Hamburg Traction Plant.—W. Wechmann.—A continuation of the long and profusely illustrated description of the recent steam-turbine extensions of the power plant of the Blankenese-Ohlsdorf single-phase road. In December, 1910, the consumption of coal per useful kw-hour was 1.64 kg (3.6 lb.), and the cost of the useful kw-hour in the power plant was 1.17 cents. The total number of useful kw-hours during that month was 2,172,236.—*Elek. Zeit.*, Nov. 23.

Electricity in Mines.—Philippi.—An illustrated review of the applications of electric energy in British mines, with special reference to the erection of one large common power plant for a number of mines, the use of electric main winding machines, the use of electric motors under ground, safety devices and wiring arrangements.—*Elek. Zeit.*, Nov. 23.

Traction.

Railway Electrification in Austria.—A. Hruschka.—The conclusion of the long and detailed illustrated report on preliminary investigations concerning the electrification of the Austrian State Railways. In the present instalment the results of this investigation are compared with those in other countries (Switzerland, Bavaria and Sweden).—*Elek. Kraftbetr. u. Bahnen.*, Oct. 24.

Installations, Systems and Appliances.

French Central-Station Statistics.—The yearly statistical tables on the status of central stations in France and its colonies in 1911. As stated in the introduction, it is rather a list of cities and towns in which electrical energy is available than a list of central stations. The statistics cover seventy-seven full pages, and in thirteen columns condensed information is given concerning the cities, companies, equipment, system used, etc. No summary of the statistics is given.—*L'Industrie Elec.*, Nov. 10.

Utilization of Waste Heat.—Otto Goertz.—The author discusses the advantages and economies of the sale of hot water or steam from central stations to municipal bath houses, apartment houses and industrial plants. If this can be satisfactorily developed the heat supply may become the main product of the stations and the electricity supply may be considered as a by-product, so that it would be possible to make a very low rate for the use of electricity for cooking and other domestic purposes.—*Elek. Kraftbetr. u. Bahnen.*, Nov. 4.

Isolated Plant.—An account of the electrical equipment of Whiteley's new building in London. The energy is generated in the firm's own station on the premises, there being six generators of 110 kw and one of 200 kw. Direct current is supplied at a pressure of 200 volts for all purposes. More than 2000 metallic-filament lamps of 200 volts are used. There are in use over twenty passenger elevators, various electrical conveyors for the transfer of goods from place to place, etc.—Lond. *Electrician*, Nov. 24.

Eddy-Current Brakes.—F. Niethammer.—An article on the design of eddy-current brakes. The article discusses the formulas of Rüdenberg for different types of eddy-current brakes, both with copper and iron brake disks, and compares them with the results of experience. He finally outlines how best to proceed in the calculation and design of such brakes.—*Elek. Kraftbetr. u. Bahnen*, Oct. 24.

Wires, Wiring and Conduits.

Electric Strength of Cables.—W. Deutsch.—The author gives a new and comparatively simple formula for calculating the "specific tension stress" (the potential gradient) in stranded cables. It is emphasized that there is a considerable difference between the behavior of a stranded cable and that of a solid conductor. It is shown that in single-phase or three-phase cables with stranded conductors the electrostatic field intensity (potential gradient) at the conductor surface is higher than with solid conductors of the same diameter, and that it increases with increasing number of strands and insulation thickness up to a maximum value which is about 30 per cent greater than the electrostatic field intensity at the surface of a solid cylindrical conductor of equal thickness. If the conductor cross-section differs from that of a circle the electrostatic field intensity is still considerably greater at the points of curvature with minimum radius.—*Elek. Zeit.*, Nov. 23.

Graphical Method for Calculating the Voltage Drop in Overhead Lines.—Nils Forssblad.—A description of a new and simple graphical method for calculating the voltage drop in the usual systems of overhead transmission lines. The fundamental new conception is the "voltage resistance" ("spannungswiederstand"), defined as the figure with which the effective current in the line, given in amperes per square millimeter, must be multiplied to get the voltage drop per kilometer of wire, if the resistance, reactance and power-factor are known. A diagram of curves is given, from which the voltage resistances may be taken, and numerical examples illustrating the method are given.—*Elek. Zeit.*, Nov. 23.

Electrophysics and Magnetism.

Inductance of Linear Conductors.—A. C. Jolley and A. F. Burgess.—The first part of an illustrated account of experiments undertaken to verify the formulas commonly used to express the inductance of a straight conductor. The limitations of the Neumann formula are pointed out, and an expression is obtained for the inductance of a couple of parallel wires as used in high-frequency measurements. Finally, the effect of neighboring bodies of iron is considered, and the effect of different types of slot as used in armature stampings is shown experimentally and for various currents. The article is to be continued.—Lond. *Electrician*, Nov. 24.

Electrochemistry and Batteries.

Manufacture of Carbon Electrodes for Galvanic Cells.—Otto Brandt.—A concise description of various methods of making carbon electrodes for primary batteries. Among them are Bunsen's method of making electrodes from coke and bituminous coal, a method of making electrodes from powdered graphite and bituminous coal tar, and Leclanché's method using hydraulic pressure. Various forms of carbon electrodes for different types of primary cells are described, among them a flexible carbon electrode with high current capacity in a small space.—*Elek. Zeit.*, Nov. 23.

Telegraphy, Telephony and Signals.

Automatic Telephony in London.—A note stating that the British Post Office telephone authorities have decided to make experiments with various automatic telephone systems. An exhibition was recently given in London of the Strowger system. It is stated that the number of telephones now operated automatically on the Strowger system in the United States is equal to half the number of telephones at work in Great Britain.—Lond. *Electrician*, Nov. 24.

Wireless Telegraphy.—The conclusion of the long detailed illustrated description of the Telefunken system of wireless telegraphy. In the present instalment various accessory apparatus and instruments are described, especially a sound intensifier, a calling apparatus, wave meters, and the buzzer.—Lond. *Electrician*, Nov. 24.

Miscellaneous.

Physiological Effect of an Alternating Magnetic Field.—S. P. Thompson.—At the recent meeting of the London Physical Society the author described his apparatus for

demonstrating in the laboratory the physiological effect of an alternating magnetic field. An alternating electric current with a frequency of 50 cycles per second is led into two large copper coils, producing an alternating magnetic field of an intensity of about 10,000 c.g.s. units in the space between the coils. If the head is placed in this space a singular sensation of a flickering bluish illumination is perceived. The effect is greatest if the direction of the lines of force of the field is through the temples.—Lond. *Electrician,* Nov. 24.

British Institution of Electrical Engineers.—Another long editorial discussing criticisms of the new proposed constitution of the (British) Institution of Electrical Engineers. There are also several letters relating to the subject.—Lond. *Electrician,* Nov. 24.

BOOK REVIEWS.

BROWN'S DIRECTORY OF AMERICAN GAS COMPANIES. Gas Statistics. 641 pages. New York: E. C. Brown.

The 1911 and twenty-fourth issue of this standard gas directory lists 1126 artificial, 528 natural, 215 acetylene and 124 gasoline gas companies. The organization and operating data are given in the body of the book, the companies being listed alphabetically by states and towns. An appendix comprising about half of the book contains financial data of the companies reported and lists of the officers, directors, committees and members of gas associations. The value of this book as the directory of a great industry is unquestionable, and it is unfortunate that convenience in reference to its contents is subordinated to advertising considerations. It would appear that no sacrifice of advertisers' interests would be involved in printing their announcements in a separate section, and it certainly would be desirable to place the title page, preface and table of contents where they could be found without a search.

MAXIMUM PRODUCTION IN MACHINE SHOP AND FOUNDRY. By C. E. Knoeppel. New York: *The Engineering Magazine.* 365 pages, 34 illus. Price, $3.

A book directed to the systematic management of foundries and machine shops for the betterment of their productiveness and finance. It has been written by a practical man who has had abundant experience in foundry work, and is intended for practical and business men. It is written in an elementary and simple, if somewhat diffusive, style, and will be serviceable to foundry managers and others.

New Apparatus and Appliances

SELF-PROPELLING CRANE.

The accompanying illustration shows a self-propelling single-motor crane designed for the lighter operations required of this class of machinery, and applicable to factories and yards which have only a limited use for cranes and hoisting apparatus. The machine is known as the Browning Engineering Company's standard No. 4 four-wheel locomotive crane, and it is propelled by a motor, controlled by one man. It has a maximum lifting capacity of 15 tons at 10-ft. radius and 2.5 tons at 40-ft. radius. The working weight is approximately 35 tons. The drawbar pull of this machine is about 7600 lb., which enables it to handle six or seven cars on a level track. The crane is equipped with a Westinghouse direct-current motor, built especially for crane service and having its frame split horizontally so that all the parts are easily accessible. The shafts are extra large and strong and the area of the commutating service is ample for good commutation. The

Single-Motor, Self-Propelling Crane.

current density in the brushes is low. High starting torque and low flywheel effect permit the quick starting, stopping and reversing required by the service. The motor shown is rated at 50 hp, 220 volts, 470 r.p.m. Standard, reversing drum-type Westinghouse controller and grid resistors are used for controlling the motor.

ELECTRIC CHAFING-DISHES AND FRYING-PANS.

The rapidly increasing use of electrically heated apparatus for domestic purposes has led to the design of various utensils and to modifications of those already designed. Examples of these are shown herewith in the frying-pan and the blazier-type chafing-dish manufactured by the Westinghouse Electric & Manufacturing Company.

The frying-pan is one of the most convenient cooking utensils that can be offered for use in homes, restaurants, hotels, etc. It is not only a complete frying-pan, capable of cooking everything that can be fried in the ordinary manner, but it can also be turned into an electric disk-stove by simply inverting it and is then suitable for all kinds of light cooking, toasting and similar uses. It is made of sheet steel and has a polished metal handle. The heating element is located in the bottom of the pan and is hermetically sealed between steel walls so that it is com-

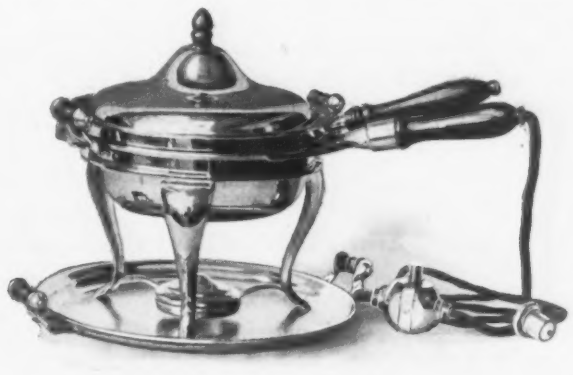


Fig. 1—Blazier-Type Chafing-Dish.

pletely protected from oxidation. The pan can be easily cleaned.

The pan heats very quickly and can be run at three different temperatures—high, medium and low. The desired temperature is obtained by means of an indicating push-button switch. The stand is made of aluminum and is so

designed that the frying-pan can be run at full heat without injuring the surface of the table on which it is supported. The whole outfit is very light.

In the Westinghouse blazier-type chafing-dish the heat is uniformly distributed over the bottom of the pan, thus eliminating the overheated center and cold sides which are

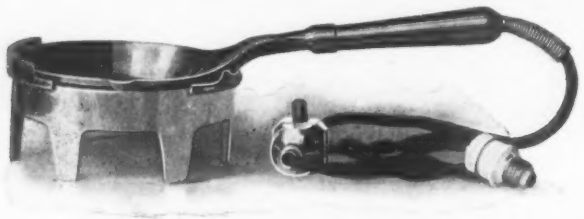


Fig. 2—Electric Frying-Pan.

unavoidable when heat from a flame is used, as in the case of the corresponding alcohol utensil. The dish can also be operated at three heats—high, medium and low—and, as the temperature at each heat is always the same, results once obtained can always be duplicated. It is always ready for use and consumes so little electricity as to be more economical than the alcohol-heated dish. This chafing-dish is similar to the ordinary type except that it has three pans instead of two—a water pan, a food pan and a blazier. The water pan and the food pan are the same as used with the ordinary alcohol chafing-dish.

The blazier contains the heating element hermetically sealed in the bottom. It is similar to the food pan in appearance and can either be used as a food pan for operations requiring high temperature, as in frying, or it can be filled with water and used to heat the food pan, which fits within it, when mild heat is wanted. An indicating plug switch controls the temperature. The high heat is ordinarily used to bring the chafing dish to the desired temperature. The low heat will keep water boiling after the boiling point is once reached and is useful for

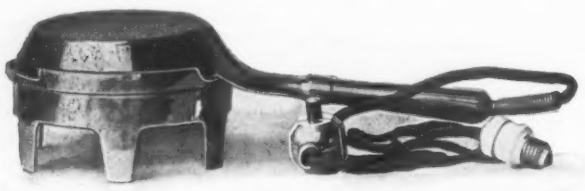


Fig. 3—Electric Frying-Pan Used as a Disk Stove.

keeping food warm. The medium heat is the highest that is usually wanted for cooking in the blazier.

All metal parts are handsomely finished in polished nickel or copper. The handles are of ebonized wood. The blazier is designed to fit the most popular sizes of chafing-dishes and contains all the parts necessary for electrical operation. By its use such alcohol chafing-dishes may be operated by electricity with no changes of any kind.

TILE AND FIBER CONDUITS.

By William D. Ligon.

Of the many types of underground electrical-conduit materials that have been employed only two are now in general use. These are the tile and the fiber conduits, a comparison of which is given below.

MULTIPLE AND SINGLE DUCT TILE.

The tile conduit has been in use for about twenty-five years. It is manufactured from vitrified clay in single duct and multiples of two, three, four and six ducts in either round or square bore. The ducts are laid end to end, with dowel pins to keep the alignment, and usually surrounded with an envelope of concrete about 3 in. in thickness, as a protection and reinforcement to the entire structure. The joints are staggered and wrapped with either burlap or iron and cemented with mortar.

This material, if properly vitrified and glazed, will last indefinitely; when free from iron it possesses high insulating properties and costs less per duct foot at the factory than any other conduit on the market to-day. It also possesses great mechanical strength and shows an average puncture test of 25,000 volts dry and 21,000 volts after immersion in water for 150 hours.

While the dielectric strength of tile is very high, the insulation of a system is greatly lowered, in consequence of the large number of joints to be closed with cement or other moisture-absorbing material, and instead of the entire system withstanding 21,000 volts it will be found when taking the joints into consideration that an installation will rarely be able to withstand more than 5000 volts, depending, however, on the general characteristics of the earth surrounding the ducts. In making the joints in multiple-duct tile it is impossible to prevent communication between the ducts, and owing to this condition multiple duct affords the lowest protection to the cables and the action of electrolysis is more liable to occur than in single-duct installations.

The weight of 3.5 in. tile is approximately 8 lb. per duct-foot, and the heavy weight therefore increases the cost of freight, handling, carrying and laying, and in propositions involving the use of tile the question of breakage is also an important item of consideration and may often amount to as much as one-tenth of the total shipment.

Owing to offsets, seams and roughness at the joints, extreme care must be exercised in pulling through the cables to prevent abrasion to the sheath, and if cables are not installed properly short-circuits and cable troubles will be encountered, thus resulting in shutdowns and expensive repairs, which increase the operating expenses to an excessive degree in the course of a year. Few manufacturers of vitrified clay recommend the use of tile bends in subway distribution, because of the roughness of the interior, and it therefore becomes necessary to replace them with manholes or hand-holes, which increases the cost of the entire system. It has been demonstrated by experience that the cost of subway installation where tile is used for conveying the cables is considerably higher than the same installation with the newer type of material, owing to the necessity of employing a higher class of labor and the large percentage of duct which is furnished without true ends and with seams, offsets, blowholes and improper glaze, and from these causes as well as others mentioned above the new class of material (fiber conduit) has rapidly come into general favor.

FIBER CONDUIT.

Fiber conduit is the most recent addition in materials for subway distribution systems that has been developed to meet the new conditions of service. It has been in use about eight years and is formed in cylindrical shape from fiber or wood pulp under pressure. The wood pulp is thoroughly saturated with a bituminous compound, and any vegetable matter or bacteria which would tend to promote decay is killed by the presence of about 6 per cent of creosote salts in solution. There are at the present time two types in general use, known as straight-joint and bell-and-spigot-joint conduit, made in four styles of joint to meet the general conditions of service, namely, socket (mortise and tenon) joint, sleeve joint, drive joint and screw joint, furnished in either 1-in., 1.5-in., 2-in., 2.5-in., 3-in., 3.5-in. or 4-in. diameter. It has been shown that the fiber conduit made by the H. W. Johns-Manville Company will withstand an average puncture test of 32,000 volts dry and 24,000 volts after immersion in water for 200 hours.

In the introduction of this material on the market there were objections to be overcome, the most serious being as

to its length of life compared with the older styles of conduit which had been used, and during the eight years of development this point has been one subject to much discussion and observation, resulting in numerous laboratory and service tests. Samples recently excavated from the first installations show no deterioration, either mechanical or electrical.

It has been found that about 90 per cent of all cable troubles are directly traceable to some injury to the lead casing when being drawn into the duct, due to the roughness of the walls and the cement which has seeped through the joint and formed cutting edges after hardening. Cable troubles are also due to high currents leaking through the joints, as a result of improper installation and the impossibility of securing perfect alignment. These objections, however, are eliminated by the use of fiber conduit, because of the smooth interior and watertight joints. Unlike joining tile conduit, the connection made with fiber conduit forms a correct alignment without the use of mandrels or dowel pins and without having to use cement, mortar or burlap at the joints.

It is also true that fiber conduit is impervious to moisture, gases, acids or other corrosive elements; thus water, gas and stray currents cannot reach the cable protected by this material. It is a good non-conductor, doing away entirely with the trouble with stray currents, and it also affords prevention against electrolysis. In the event of short-circuit the wall immediately surrounding the arc may char, but the fire will not spread, and hence the cables may easily be removed from the ducts.

In figuring on subway installations it has been fully demonstrated by the experience of the largest operating companies that on account of the lightness in weight large savings can be effected in freight, trucking, excavating, handling, laying and the amount of concrete necessary. In shipping and handling fiber conduit breakage is practically nothing, owing to the great tensile strength of the wall and the shock-resisting properties of the material

Samples of conduit which were placed in an oven and the temperature greatly raised show that at 135 deg. Fahr. softening of the compound began, and that at 205 deg. the compound became very soft, but the mechanical strength of the material was such that the samples retained their shape, the change taking place only in the impregnating compound. However, in actual service the high temperatures named are not likely to occur, as the cable insulation would give way.

In the accompanying tables are shown the actual costs of installing single-duct and multiple-duct tile and fiber conduits as compiled from experience by the H. W. Johns-Manville Company, New York.

In considering the merits of the two more important

TABLE I.—COST TO CONSTRUCT MULTIPLE-DUCT TILE CONDUIT IN STREETS PAVED WITH GRANITE OR EQUIVALENT PAVING, EXCLUSIVE OF MANHOLES.

Duct Sections.	1	2	3	4	6	8	12	16	20	24
Excavating, refilling, paving and disposal of dirt	$0.230	$0.361	$0.546	$0.397	$0.559	$0.590	$0.637	$0.791	$0.867	$0.939
Concrete	0.104	0.131	0.152	0.160	0.192	0.243	0.269	0.333	0.368	0.384
Cost tile delivered	0.053	0.106	0.159	0.212	0.318	0.424	0.636	0.848	1.060	1.272
Laying tile	0.030	0.040	0.060	0.080	0.120	0.160	0.240	0.320	0.400	0.480
Cleaning ducts	0.005	0.010	0.015	0.020	0.030	0.040	0.060	.080	0.100	0.120
Water, bridging and shoring	0.005	0.007	0.010	0.012	0.020	0.025	0.030	0.040	0.050	0.060
Tool repairs and replacement	0.010	0.010	0.010	0.012	0.020	0.025	0.030	0.040	0.050	0.060
Incidentals	0.010	0.010	0.010	0.010	0.012	0.015	0.018	0.024	0.030	0.036
Supervision, inspection and time-keeping	0.036	0.052	0.072	0.072	0.095	0.114	0.192	0.247	0.292	0.339
Total per trench foot	0.483	0.727	1.034	0.975	1.366	1.636	2.112	2.723	3.217	3.690

TABLE II.—COST TO CONSTRUCT SINGLE-DUCT TILE CONDUIT IN STREETS PAVED WITH GRANITE OR EQUIVALENT PAVING, EXCLUSIVE OF MANHOLES.

Duct Sections.	1	2	3	4	6	8	12	16	20	25
Excavation, refilling, paving and removing surplus earth	$0.259	$0.353	$0.494	$0.430	$0.536	$0.722	$0.788	$0.858	$0.996	$1.072
Concrete	0.105	0.145	0.185	0.192	0.239	0.287	0.348	0.412	0.474	0.540
Cost tile delivered	0.054	0.108	0.162	0.216	0.324	0.432	0.648	0.864	1.080	1.350
Laying tile	0.030	0.060	0.090	0.120	0.180	0.240	0.360	0.480	0.600	0.750
Cleaning ducts	0.005	0.010	0.015	0.020	0.030	0.040	0.060	0.080	0.100	0.125
Water, bridging and shoring	0.005	0.007	0.010	0.012	0.020	0.025	0.030	0.040	0.050	0.062
Tool repairs and replacement	0.010	0.010	0.010	0.012	0.020	0.025	0.030	0.040	0.050	0.062
Incidentals	0.010	0.010	0.010	0.010	0.012	0.015	0.018	0.024	0.030	0.037
Supervision, inspection and time-keeping	0.036	0.053	0.073	0.076	0.102	0.134	0.171	0.210	0.253	0.299
Total per trench foot	0.514	0.756	1.049	1.088	1.643	1.920	2.453	3.008	3.633	4.297

TABLE III.—COST TO CONSTRUCT FIBER-PIPE CONDUIT IN STREETS PAVED WITH GRANITE OR EQUIVALENT PAVING, EXCLUSIVE OF MANHOLES.

Duct Sections.	1	2	3	4	5	8	12	16	20	25
Excavation, refilling, paving and removing surplus earth	$0.230	$0.343	$0.431	$0.381	$0.481	$0.601	$0.655	$0.716	$0.848	$0.919
Concrete	0.090	0.126	0.163	0.175	0.224	0.273	0.344	0.417	0.490	0.572
Cost fiber pipe delivered	0.051	0.102	0.153	0.204	0.306	0.408	0.612	0.816	1.020	1.275
Laying fiber pipe	0.010	0.020	0.030	0.040	0.060	0.080	0.120	0.160	0.200	0.250
Proving ducts	0.003	0.005	0.007	0.010	0.015	0.020	0.030	0.040	0.050	0.062
Water, bridging and shoring	0.005	0.007	0.010	0.012	0.020	0.025	0.030	0.040	0.050	0.062
Tool repairs and replacement	0.010	0.010	0.010	0.012	0.020	0.025	0.030	0.040	0.050	0.062
Incidentals	0.010	0.010	0.010	0.010	0.012	0.015	0.018	0.024	0.030	0.037
Supervision, inspection and time-keeping	0.031	0.047	0.061	0.063	0.085	0.101	0.138	0.169	0.205	0.243
Total per trench foot	0.440	0.670	0.875	0.907	1.223	1.548	1.977	2.422	2.943	3.482

materials for underground systems of distribution it must be understood that each has its important field, and the conditions which govern these installations are to be considered carefully from the standpoint of interest and depreciation on the investment and the best service that can be obtained without interruption. The question of mechanical strength of fiber or tile when laid in concrete is of little importance, as the best concrete to-day will withstand a compression test of about 3000 lb. to the square inch, which is ample to meet the most exacting conditions of service.

ELECTRICALLY HEATED PILLOW.

The comfort of a hot-water bottle for sick-room use is impaired by its rapid cooling. When first applied it is likely to be too hot, but it very shortly becomes so cold as to be of little benefit. The ideal means of local application of heat is, of course, the electric heating pad, which will remain at a uniform temperature for any desired period. To this end the Jupiter Electric Products Company, Cleveland, Ohio, has developed the electrically heated pillowette illustrated herewith. This pad measures 13 in. by 16 in. and is flat, thin and flexible so that it can be wrapped around any part of the body. Asbestos surrounds the electric heating element, and this is in turn inclosed in a rubber case and eiderdown slip. The eiderdown envelope can be removed for washing. A thermostatic cut-out prevents the temperature of the pad from rising unduly, and the three-heat switch enables any intermediate temperature to be held.

BATTERY-DRIVEN DELIVERY WAGON.

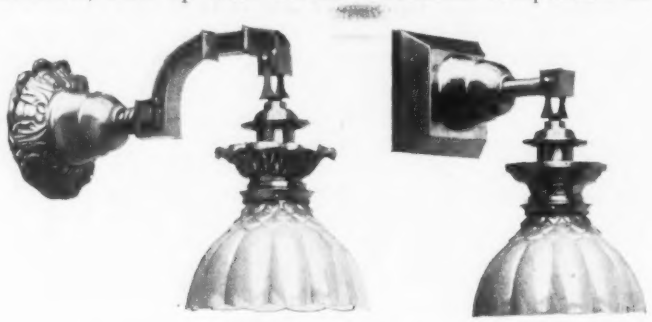
The electric delivery wagon is simpler to operate than any other motor-propelled vehicle, lasts longer than other cars, takes the place of two horse-drawn wagons, occupies the stable room of less than one, doubles the radius of horse-drawn delivery, consumes energy only when in use, is odorless and devoid of fire risk, and in general can be used to deliver goods more cheaply, quickly and dependably than any other form of delivery service.

The Hupp Corporation of Detroit, maker of the Hupp-Yeats pleasure vehicles, has recently added a commercial department, which is building 1000-lb. electric delivery wagons, weighing 2300 lb. and having an 86-in. wheel-base with solid tires. Motor and controller are of the Westinghouse vehicle type, and the standard battery equipment includes three trays of twenty-seven "Hycap Exide" cells with a capability of 27 amp for five hours. The wagons are designed for a delivery radius up to 20 miles and will run 50 miles per charge, depending on the condition of the roads. Front axles are of the inverted Lemoine type with wheel pivots fitted with imported ball bearings. The rear axle is of the semi-floating type, the motor being attached directly to the axle housing and driving through bevel gears. The car body has a total inside length of 44 in., a height of 54 in. and a width of 41 in.

SIDE-WALL ELECTRIC-LIGHT FIXTURES.

The side-wall fixtures illustrated herewith are an extension of the line of "T T C" tungstoliers, manufactured by the Tungstolier Company, of Conneaut, Ohio. Fixtures of this type are constructed on the sectional principle, all parts—arms, bodies, canopies and stems—being so interchangeable that with eighty-six parts it is possible to make up 1944 absolutely different fixtures, ranging in design from simple types for the small residence to the most ornate equipment for public buildings. It is also possible to increase the number of lights on a chandelier fixture from two to three, four or more, by simply inserting and repositioning the arms.

In addition to the chandelier types of these fixtures, there are now available a companion series of side-wall brackets, built up from the same sectional components as

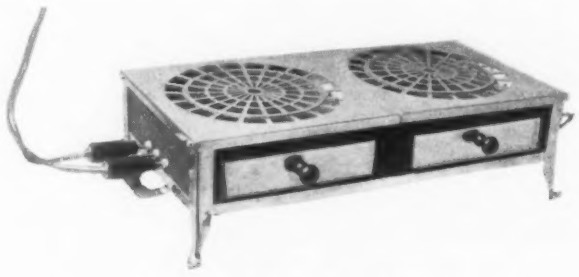


Side-Wall Fixtures.

shown in the illustrations and as readily adaptable to all conditions of service. As contrasted with the traditional "inverted forest" that marks the showroom of the dealer in "regular" fixtures, these fixtures are packed in square pasteboard cartons, and the stock is stored on shelves out of the way and free from dust and danger, for the salesman demonstrates the line by the manipulation of a single complete set of fixture parts. From the salesman's point of view this is of the greatest advantage, as the customer sees one fixture type at a time, instead of a hundred. There is consequently less confusion and indecision, and the dealer's time is saved.

COMBINATION ELECTRIC STOVE AND TOASTER.

The accompanying illustration shows a two-burner combination stove and toaster manufactured by the Cadillac Electric Manufacturing Company, Cadillac, Mich. This is one of three types built by the company, the others having a single burner and three burners. In addition there is another form of two-burner stove made which differs from the regular stove only in that one of the units is equipped with a single heat burner, giving twice the heat for rapid cooking. In all of the stoves the heat is regulated by changing the relative position of the two plugs on the three pins at one side of the stove. The drawers underneath the heating coils may be used for broiling chops or for keeping toast or other food warm, as it is possible to regulate the stove for fast cooking, simmering or keeping food warm. In the three-burner type of stove the center burner gives twice as much heat as the outer burners and has a deep broiling drawer for a thick steak. The heating element being in the center between the drawer and the



Combination Stove and Toaster.

upper grid, it is possible to make toast or broil a chop in the drawer and at the same time brew tea or a pot of coffee on the grid above. The drawers are made of aluminum, and the stove is finished in nickel. The three-heat burner is designed for consuming 550 watts and the single-heat burner for 1100 watts.

Industrial and Commercial News

THE WEEK IN TRADE.

WITH moderate activity reported in most of the leading industries, the prospects for a period of good business appear very favorable. Transactions in pig-iron in the past few weeks have averaged 200,000 tons per week, and this figure gives signs of early increase. Consumers, attracted by low prices, are placing orders in encouraging amounts for present needs, and many are contracting for their requirements well into 1912. Unfilled orders on the books of the Steel Corporation as of Nov. 30 aggregated 4,141,955 tons, which represents a gain of 447,627 tons as compared with the tonnage shown in the October statement. Most of the contracts being placed at this time for steel are for shapes for bridges and buildings, and new business from this source is increasing rapidly. Negotiations are now in progress for some 100,000 tons of steel, and it is thought that the greater part of this will be placed this month. Slightly higher prices for cars have delayed closing of many railroad contracts, but as it is rather generally believed that these prices will not hold, substantial orders for cars and other equipment are expected to be given out within a short time. Work is now being resumed at many plants that have been idle since last May. Wire products have been advanced $1 per ton. The Department of Agriculture's official estimate of the 1911 cotton crop issued on Monday placed the total at 14,885,000 bales, which is 1,447,000 greater than the previous record in 1904. The Railroad Securities Commission, created in 1910 to investigate federal control of railroad securities, made its report on Monday, and strongly recommended publicity concerning all securities issued by interstate roads; but stated that it believed the time inopportune for federal control of railroad stock issues. The Supreme Court of the United States denied the petition of the independent tobacco companies asking review of the American Tobacco dissolution case, so that any further effort to open the case will have to be made through Congress. Business failures for the week ended Dec. 7, as reported by *Bradstreet's*, were 267, as compared with 216 in the previous week, 267 in the corresponding week in 1910, 259 in 1909, 298 in 1908 and 284 in 1907.

THE COPPER MARKET.

DECREASE of 23,212,454 lb. in surplus stocks was shown in the November statement of the Copper Producers' Association. This reduction, the largest reported in any month this year, was highly surprising in view of the lassitude shown in the market during the greater part of November. Production was placed at 111,876,601 lb., as compared with 118,225,-

Standard Copper.	Bid.	Asked.	Settling Price.
Spot	13.15	13.40	....
December	13.20	13.37½	13.27½
January	13.20	13.40	13.30
February	13.25	13.40	13.32½
March	13.25	13.50	13.37½
April	13.25	13.50	13.37½

The London market, Dec. 13, was as follows:

	Noon. £ s d	Closing. £ s d
Standard copper, spot	60 16 3	61 13 9
Standard copper, futures	60 11 3	61 8 9

Extreme fluctuations for this year.

	Highest.	Lowest.
Standard	13.27½c	11.57½c
London, spot	£60 17 6	£53 7 6
London, futures	61 15 0	54 0 0
Best selected	64 5 0	57 5 0

442 lb. in October, and was the smallest reported since February, 1911, when the output was 109,828,297 lb. Total deliveries were 135,089,055 lb., as compared with 124,152,625 lb. in the preceding month. Domestic consumption was given as 68,039,776 lb., as compared with 64,068,307 lb. in October, and was the largest since January, 1910. Exports for the month were 67,047,279 lb. as compared with 60,084,349 lb. in October, and were the largest since last June. Stocks on hand at the end of the month, according to the report, were 111,785,188 lb., as compared with 134,997,642 lb. at the end of October, and were the smallest since February, 1910. In spite of the curtailed production, the rate of output is still too high for absorption under present conditions, and the attitude prevailing toward this phase of the copper industry was voiced this week by a prominent attorney, who expressed himself in favor of new legislation authorizing producers to make an agreement to reduce the copper output to a point where only the world's legitimate demands will be supplied. Prices have increased since the November report was issued, and electrolytic has been quoted at 13.45 cents to 13.50 cents cash, and 13.55 cents to 13⅝ cents delivered thirty days for January and February shipment. Exports for the month, including Dec. 13, aggregate 13,578 tons. The daily call on the Metal Exchange Dec. 13 quoted copper as per the accompanying table.

INDUSTRIAL AND COMMERCIAL NOTES.

H. W. Johns-Manville Company to Build General Eastern Factory.—Plans are being made by the H. W. Johns-Manville Company, manufacturer of asbestos, magnesia coverings and electrical supplies, to move from its present plant at the foot of Thirty-ninth Street, South Brooklyn, New York. The chief reason for making this change is the desire of the company to establish a general Eastern factory which shall have ample capacity to meet all the requirements for its products in this part of the country and have room for expansion. The present site does not offer these possibilities, and was moreover condemned some five years ago by the city authorities to make way for sites for municipal ferries. While no further action has been taken by the city since that time, the company naturally would not care to develop the section further even if this were possible. No site has been decided upon for the new factory, but the company is considering a tract of 290 acres at Finderne, N. J., which is about half way between Bound Brook and Somerville, N. J., on the Central Railroad of New Jersey. The new factory will be modern in every respect and will be of fireproof construction throughout. The number of buildings has not yet been decided upon, but each will be 150 ft. wide and 1000 ft. in length and they will be 150 ft. apart. They will be one-story, of saw-tooth construction, and either of tile and asbestos stucco or brick, with steel framing throughout. A 10,000-kw plant will be installed by the company in the new factory, and this matter is now under consideration by several of the large manufacturers of power-plant equipment. The number of employees of the new plant will be between 2500 and 3500, and the present plans include the construction of houses for the working force. It will take about two years to construct the new plant, and it is hoped that ground will be broken by Jan. 1, 1912. Work is now progressing rapidly on the new office building for the H. W. Johns-Manville Company at the southwest corner of Madison Avenue and Forty-first Street, New York, which is to be used as an executive office by the company. There have been several delays on this work due to the strike of marble workers, etc., but the company now hopes to occupy the building shortly after Jan. 1.

Isthmian Canal Commission in the Market for Electric Supplies.—Sealed proposals in triplicate are sought by the general purchasing officer of the Isthmian Canal Commission, Washington, D. C., by Jan. 6, 1912, for cross bonds, bond terminals, bare copper cable, bonds for steel conductor rails, galvanized-steel conduit, flexible conduit, combination couplings, box couplings and steel splice bars for conductor rails. Persons interested should apply for Circular No. 666. The material is required for rack railway and miter gates, the latter being operated by electric motors.

Pennsylvania May Electrify Pittsburgh Lines.—It is reported that the Pennsylvania Railroad Company has had surveys made with a view to electrifying about 15 miles of its main line out of Pittsburgh and that about $15,000,000 will be required for this work alone. Elimination of grade crossings, purchase of electric locomotives, etc., it is estimated, will increase this figure to over $30,000,000.

Great Western Power to Add 20,000 Kw to Big Bend Station.—The Great Western Power Company, of New York and San Francisco, will add to the equipment at its Big Bend station on the Feather River, California, two 10,000-kw units similar to those now in service. The station will then have an aggregate rating of 60,000 kw in 11,000-volt, three-phase, 60-cycle units. During November the station carried its rated output continuously for thirty days without interruption, and, in order to provide reserve apparatus as well as to take care of additional load, it was decided to augment the equipment immediately. The company is also engaged in laying a cable across the Bay of San Francisco at the present time from its terminal station at Oakland. The cable is of the submarine type designed for 11,000 volts and to transmit 10,000 kw. It is 7 miles long. Preliminary work at Big Meadows having been completed, the Great Western Power Company will commence the erection of a great dam at that point in the spring. When completed the dam will have a 900-ft. crest and be 110 ft. high. It will be capable of holding one of the greatest artificial bodies of water in the world, impounding approximately 1,000,000 acre-feet. This with the normal flow in the Feather River will make it possible to generate continuously 400,000 hp. H. H. Sinclair will be in charge of the work on the dam, which will be only partly completed at present. It is questionable if the station at Big Bend will be enlarged much beyond 60,000 kw for some time to come. The probabilities are that as soon as a market for the energy is secured another station will be erected near the Big Meadows, where there is a fall of 2000 ft. in 10 miles. Between this site and the present station at Big Bend there is another site where a fall of from 300 ft. to 400 ft. is available. The Great Western Power Company owns all these sites; but their development will depend on the power market and the result of negotiations at present pending between it and the Pacific Gas & Electric Company.

East Creek (N. Y.) Station Ready to Turn Over.—The hydroelectric station of the East Creek Electric Light & Power Company, which Messrs. Viele, Blackwell & Buck, of New York, have been engineering, will start operating next week. The station is located at Ingham Mills, N. Y., where there is a head of 120 ft. The equipment at present installed consists of two 4000-hp Pelton-General Electric units wound for 2300 volts, three-phase, 25 cycles. The energy will be stepped up to a potential of 33,000 volts for transmission on steel towers to the Tribes Hill station of the Fonda, Johnstown & Gloversville Railroad. Space is provided in the station for another 4000-hp unit, and the line is built for a potential of 60,000 volts. Six conductors of No. 2 solid copper form the transmission circuits with a 3/16-in. steel ground wire overhead and two No. 6 telephone wires underneath. A 16,000-volt line connects the new station with the old station 3 miles below, where a frequency-changer is installed to receive the energy and transmit it at 60 cycles to Fort Plain and Canajoharie, the company selling energy in bulk to the companies operating in these towns. Eventually it is proposed to demolish the old station and supply the load direct from the new station. The General Electric Company is indirectly interested in the project.

Western Conduit & Manufacturing Company. — The Youngstown Sheet & Tube Company, Youngstown, Ohio, has acquired an interest in the Western Conduit & Manufacturing Company, of Chicago, which has resulted in a reorganization of that concern. The capital stock has been increased from $50,000 to $100,000 and the following officers have been elected: L. J. Campbell, president; W. J. McKay, vice-president and general manager; J. H. Rogers, secretary and general manager sales; C. C. Rose, treasurer. The above-named, together with Richard Garlick, constitute the board of directors. As soon as a new factory can be erected at Youngstown, Ohio, the company will move its headquarters to that place. This removal will probably occur some time next spring. It is the intention of the company to build at Youngstown a modern factory of large capacity for the manufacture of its well-known rigid conduit, "Harveyduct," as well as a factory for the manufacture of "Realflex," the new flexible armored conductor which the company has recently put upon the market. If the increase already made in the capital is not sufficient to take care of the improvements planned, it is probable that further additions to the capital stock will be made

Investigation of Tennessee Water-Power.—A party of capitalists interested in the development of hydraulic power and electric railway facilities throughout Tennessee is now touring that State in a private car, having made stops within the past week in Knoxville and Chattanooga. The party is investigating water-power development along the Ocoee River, and is also interested in the improvements which are being made in the properties of the Chattanooga Railway & Light Company. A comprehensive tour will probably result in the extension of investment in that portion of Tennessee. The party is composed of the following: Arthur Newbold, of Drexel & Company, Philadelphia, Pa.; A. H. Hodenpyl, of Hodenpyl, Hardy & Company, New York City; E. W. Clark, C. M. Clark, of E. W. Clark & Company, Philadelphia, Pa.; H. F. Reed, of J. G. White & Company, New York City; Clement Newbold, of Newbold & Company, Philadelphia, Pa.; George H. Richardson, of Richardson & Clark, Providence, R. I.; G. L. Estabrook and H. S. Hopkins, of E. W. Clark & Company, Philadelphia, Pa.

Proposed Hydroelectric Plant on Ohio River.—James M. Ashley, of Toledo, Ohio, president of the Auglaize Power Company, which is building a 6000-kw hydroelectric plant near Defiance, Ohio, as stated in these columns Oct. 7, is named as president of a new three-million-dollar company which has been organized for the purpose of installing a hydroelectric plant on the Ohio River, nead Letart Falls, Meigs County, Ohio. Several other leading interests in the Auglaize company are mentioned in connection with the new company, and it is believed that foreign capital will be represented in the new project. It is also stated that the minimum capacity of the plant will be about 50,000 hp, and while the field for sale of the energy generated has not been definitely arranged for, the plans of the company include furnishing energy to towns in the Ohio River valley and possibly Columbus or Cincinnati. Authority for building dams and locks is said to have been already secured from the War Department.

Warning Against Central-Station Swindler. — A forger who has operated under various aliases as a representative of the Kentucky Electric Company, of Louisville, Ky., in the South during the past few weeks, and who has succeeded in cashing a number of drafts and checks drawn on the Louisville concern, is now reported to be working the same plan in New York State. President Robert E. Hughes, of the Kentucky Electric Company, said last week that news of the swindler's depredations in the East had been recently received. A printed form of checks and drafts, to all intents and purposes standard with the company, is used, the stranger representing to the trade that he is selling electrical supplies of Kentucky Electric manufacture, the business of which, as a matter of fact, is exclusively that of a central station. One of the names given in the forger's operations is F. A. Delaney. Efforts are now being made by the police authorities to apprehend him.

Panama Hydroelectric Plant Award.—The Pelton Water Wheel Company has been awarded a contract for the complete hydraulic power equipment for the hydroelectric plant in connection with the Panama Canal. This will consist of three 3600-hp vertical-shaft Pelton-Francis turbines, operating under 75-ft. head at 250 r.p.m., for driving General Electric steam-turbine-type generators; three pipe lines, each 10 ft. 6 in. in diameter by approximately 300 ft. long; Pelton oil-pressure water-wheel governors and head gates. The plant will be located at Gatun Dam, and the power will be used by ship-towing electric locomotives and for operating locks, lighting and general power purposes on the canal.

New Aluminum Plant.—The Aluminum Company of America has purchased rights-of-way for 40 miles along the banks of the Little Tennessee River in Blount County, Tenn., and across the state line to North Carolina. It is reported that the company expects to expend between $12,000,000 and $15,000,000 in the construction of a series of dams in the stream and an electric power house which will furnish 200,000 hp to be used in the production of aluminum. The company is capitalized at $20,000,000, produces practically all the aluminum made in America, and has plants in East St. Louis, Ill., Niagara Falls and Massena, N. Y.

Roebling Company Not Handicapped by Recent Fire.—Reports of damage caused by a recent fire at the Trenton (N. J.) works of the John A. Roebling Sons' Company have been greatly exaggerated. The fire was confined to one shop, which was used in the manufacture of special wire, and the facilities of the other shops will be ample to take care of all work that would have been done in the burned shop.

Financial.

THE WEEK IN WALL STREET.

ALTHOUGH the volume of trading has been rather light this week, prices have shown marked improvement. Following news that the Supreme Court would not reopen the American Tobacco case and publication of the report of the Railroad Securities Commission, Monday's market, after early dullness, assumed a vigorous tone, and considerable expansion took place in the transactions, accompanied by net gains of a point in many of the active stocks. This improvement in the scope of trading was not maintained on Tuesday, but prices went higher, though most of the gains were only fractional. Further bids by Berlin bankers for funds to carry over the end of the year were the feature of the money market during the day. After several hours of hesitation, the market became exceedingly active on Wednesday, following the issuance of a highly optimistic statement by an authority on the steel situation, who predicted the imminence of a boom in the steel trade equal to that in 1909. Among the items of general news attracting interest in the financial district on Wednesday were recommendations made to the Senate interstate commerce committee by a director of the Steel Corporation calling for the creation of a business court as a source of relief from present depression. Money rates on Dec. 13 were: Call, 3¾ @ 4 per cent; ninety days, 4 @ 4¼ per cent. The quotations in the tables are those at the close Dec. 13.

NEW YORK.

	Dec. 6.	Dec. 13.	Shares Sold.		Dec. 6.	Dec. 13.	Shares Sold.
All. Ch.....	2½	1⅞	3,100	Int. Met., pf.	46⅝	48	6,245
All. Ch., pf..	9	8	2,650	Mackay, Cos.	83*	81½*	100
Amal. Cop..	61⅛	64⅝	75,000	Mackay C.,pf.	72¾	72⅜*	330
Am. D. T...	33⅛*	33⅛*	———	Man. Elev...	135*	136	———
Am. Loco....	35	37	300	Met. St. Ry.	15*	15*	———
Am. Loco.,pf.	102⅝	103	110	N.Y.&N.J.Tel.	139½*	139½*	———
Am. Tel. & C.	78*	78*	———	Steel, com..	62¾	66⅜	350,600
Am. T. & T..	139	140	9,150	Steel, pfd....	109¼	110⅞	6,100
B. R. T.....	77	76¾	5,775	W. U. T....	78⅛	79	800
Gen. Elec....	152¼	154¼	1,900	West'h, com.	65*	66	1,000
Int. Met....	14¾	15¼	6,400	West'h, pfd..	113*	113*	———

PHILADELPHIA.

	Dec. 6.	Dec. 13.		Dec. 6.	Dec. 13.
Am. Rys.....	46	45½*	Phila. R. T.....	23¼*	23
El. Co. of A.....	11⅞*	12	Phila. Elec.....	16	15¼
Elec. St. Bt'y.....	54	54½	Phila. Trac.....	84⅞	84½
Elec. St. Bt'y., pf..	30*	30*	Union Trac.....	52¼	51½

CHICAGO.

	Dec. 6.	Dec. 13.		Dec. 6.	Dec. 13.
Chi. City Ry.....	186*	186*	Com. Edison.....	133½	135½
Chi. Elev. Rys.....	29*	29*	Chi. Subway.....	⅜*	⅜*
Chi. Elev. Rys., pf.	94*	94*	Chi. Telephone.....	138¾	139
Chi. Rs., Ser. 1....	95*	95*	Nat'l Car.....	104*	103
Chi. Rs., Ser. 2....	34⅞	34⅝	Nat'l Car, pfd.....	118*	118

BOSTON.

	Dec. 6.	Dec. 13.		Dec. 6.	Dec. 13.
Am. T. & T.....	139	140	Mex. Tel.....	3¼*	3¼*
Cum. Tel.....	157	157	Mex. Tel., pf.....	6½*	6½
Edison	290	292	N. E. Tel.....	154*	163¼
Gen. Elec.....	153	154	W. T. & T.....	27½*	27½*
Mass. E. Ry.....	22	21⅝	W. T. & T., pfd....	104¼*	64¼*
Mass. E. Ry., pf....	93	93½			

*Last price quoted.
Shares old for the week, Dec. 4 to Dec. 9.

FINANCIAL NOTES.

Allis-Chalmers Reorganization.—With a view to placing the company on a more substantial basis, financially and physically, committees of preferred and common stockholders of the Allis-Chalmers Company have been formed in addition to a bondholders' committee, of which J. N. Wallace, of the Central Trust Company, is chairman, who may confer with the directors in regard to raising the necessary funds to meet the requirements of the company. As we go to press these committees have merely perfected their organization. The Allis-Chalmers Company has an authorized capital stock of $25,000,000 7 per cent cumulative preferred, of which $16,050,000 is outstanding, and $25,000,000 common, with $10,820,000 outstanding. There is an authorized 5 per cent bond issue of $15,000,000, of which $11,148,000 is outstanding, and in addition the company guarantees 6 per cent on $1,170,000 Bullock Electric Manufacturing Company 6 per cent preferred stock. No dividend has been forthcoming since February, 1904, and its securities have reached a very low level. The common stock, which in 1906 was worth 27⅜, was quoted as low as 1¾ on Monday, and the preferred, which was listed at 87½ in 1903, was sold for 8½ on Tuesday. On Wednesday the closing quotations on common and preferred were 1⅞ and 8, respectively. The bonds also broke, and although selling for 79 last May, were down to 51 on Wednesday. Before the first of the year the company will be obliged to raise $287,000 for bond interest; $80,000 to $130,000 for interest on floating debt, and $31,500 guaranteed dividends on Bullock Electric Manufacturing Company stock, in addition to securing new working capital to reduce the floating debt and to enable the company to accept whatever new business is offered. As is well known, the company has extensive works at Scranton, Cincinnati, Chicago, Milwaukee and West Allis, and manufactures chiefly heavy apparatus. Its products embrace steam, gas, water and electric machinery, and not having an extensive line of small apparatus and supplies, its prosperity is linked with the amount of new work undertaken in its respective fields from year to year. The electrical products form only a small part of the company's activities, and in this line it has stiff competition from the General Electric and Westinghouse companies. The destinies of the Allis-Chalmers Company are shaped by the following officers: E. H. Gary, of the United States Steel Corporation, chairman of the board of directors; W. V. Kelley, of Chicago, chairman of the finance committee; D. W. Call, president; Messrs. L. F. Bower and D. Van Alstyne, vice-presidents; H. Woodland, vice-president and treasurer; W. W. Nichols, vice-president and secretary; W. A. Thompson, controller; M. W. Babb, general attorney and assistant secretary; E. C. Welborn, assistant treasurer, and W. P. Harper, purchasing agent. The directors are Messrs. E. D. Adams, E. H. Gary, C. MacVeagh, W. A. Read, C. Vanderbilt, C. Allis, H. W. Falk, D. W. Call, W. H. Whiteside, H. Woodland, D. Van Alstyne, A. F. Banks, M. Pam, W. V. Kelley, K. K. Knapp, F. O. Wetmore and S. S. Palmer.

New York, New Haven & Hartford Transfers Its Control of Connecticut Lighting Companies.—Acting with the Connecticut Company, which operates its electric railways, and with the Housatonic Power Company, to which it had transferred all the gas, electric light and power companies formerly operated by the Connecticut Company, the New York, New Haven & Hartford Railroad Company has in the form of a sub-lease practically given up its control in the Connecticut lighting companies. The new lease is made to a corporation known as the United Electric & Water Company, which is a corporation chartered by the Connecticut Legislature, and is believed to represent the United Gas Improvement Company of Philadelphia, and practically the same interests that were active in getting the New Haven road to take the properties originally and that now take them back. The sub-lease calls for payment by the lessee of $365,000 per year.

Tri-City Railway & Light Earnings.—Substantial improvement was shown in the earnings of the Tri-City Railway & Light Company, of Davenport, Ia., in the twelve months ended Oct. 31, as compared with those in the corresponding period in the previous year. After deduction of all charges, including sinking-fund allowances, preferred stock dividends, replacement and renewal funds, there was left a surplus of $314,672, or 3.49 per cent on the $9,000,000 outstanding common stock. The deduction for renewal and replacement fund amounted to $83,000, whereas nothing was charged against earnings for this item during the previous year, when the surplus was equivalent to 3.54 per cent on the same amount of stock. As the surplus would have been equivalent to 4.42 per cent had conditions been the same, officials of the company regard the showing for the period as very favorable.

A Canadian Telephone Complication.—The Bell Telephone Company of Canada has withdrawn an offer made to the city of Windsor about Nov. 1 because the City Council insisted upon submitting it to a vote of the people. The company had agreed to pay into the city treasury $1,500 a year for five years in consideration of a grant for the exclusive right to operate in the city. Several members of the Council wanted further concessions, but it was finally decided to submit the matter to a vote in January. Local Manager Dewar states that the company can operate under its Dominion charter and that it is satisfied to go ahead without any exclusive right, rather than submit to the course the Council had decided upon.

Shawinigan Water & Power Company to Issue More Stock.—Stockholders of the Shawinigan Water & Power Company, of Montreal, Quebec, will meet Dec. 27 to ratify an issue of $500,000 4½ per cent debenture stock.

Will Rehabilitate United Wireless Telegraph Company.—The Hon. John Howard Hill and Philip G. Clifford, both of Portland, Maine, and Robert H. Montgomery, of New York City, trustees in bankruptcy for the United Wireless Telegraph Company, which went into bankruptcy last July, and several of whose principal officers were convicted of fraud in connection with the company's affairs and are now serving sentences in the federal penitentiary, as noted in these columns from time to time, have taken active steps to reorganize the company on a sound basis, and with this end in view they have called a meeting of the stockholders for Saturday, Dec. 16, at the office of Saul S. Myers, 60 Wall Street, New York. Mr. Myers is, with Woodman & Whitehouse, of Portland, Maine, counsel for the trustees in bankruptcy, and was active in bringing about the appointment of a federal receiver, following applications made by various groups of stockholders in a great many different states for receivers in these states, after the company's affairs became involved. The trustees are now operating some 500 wireless stations, valued at nearly $500,000, and in addition to these quick assets there are stated to be heavy claims in favor of the company against some of its directors, on which it is expected many times the indebtedness of the company can be realized. This applies not only to directors who are in jail, but also to directors who, it is claimed, participated in the transactions which led to the defrauding of the stockholders. In addition, there is important patent litigation pending which must be taken care of, and in the event of a successful termination the business will apparently be in better shape than ever before. The claims of the merchandise creditors amount to about $75,000, and there is also the cost of the bankruptcy proceedings, some $75,000, to be met. The reorganization plan provides for the payment of these claims in full, possibly by levying a small assessment upon the stockholders, and the formation of a new company to take over the assets of the present company. The trustees are also using every effort to locate the funds that were misappropriated by officials of the company, and with this object Christopher C. Wilson, former president of the company, is to be brought to New York from the federal prison at Atlanta within a short time and examined before a United States commissioner as to his knowledge of the whereabouts of these funds.

Interborough Rapid Transit Earnings.—Gross operating revenue of the Interborough Rapid Transit Company, of New York City, in October were $2,707,569, as compared with $2,547,654 in October, 1910. Passengers carried in October, 1911, and October, 1910, were 52,717,754 and 49,543,316 respectively. Operating expenses in October last were $1,079,598, as compared with $981,748, and net operating revenue was $1,627,972, as compared with $1,565,906. Deduction of fixed charges left a net corporate income of $595,946 for the month, as compared with $535,951. In the four months ended Oct. 31, 1911, gross operating revenue was $9,314,938, as compared with $8,968,020 in the corresponding four months in 1910. Operating expenses increased considerably, being $4,154,214, as compared with $3,727,518, and the increase is due in a large measure to extraordinary expenses, changes in equipment necessitated by operation of ten-car expresses and six-car local trains. Taxes in the respective periods were $655,021 and $611,871, leaving income from operation amounting to $4,505,702 in the 1911 period, as compared to $4,628,630 in 1910. Other income in the periods was $122,857 and $117,804, bringing total income to $4,628,559 in the four months ended Oct. 31, 1911, and to $4,746,434 in the four months ended Oct. 31, 1910. Deduction of fixed charges left net corporate income of $1,004,622, which compares with $1,188,464 in the period ended Oct. 31, 1910. The company carried 180,743,699 passengers in the 1911 period and 173,790,798 in the 1910 period.

Consolidation of Electrical Properties in Kentucky.—The Kentucky Public Utilities Company, of Frankfort, Ky., has been formed to take over the properties of the Capital Gas & Electric Light Company, Frankfort; Owensboro Gas Light Company, Owensboro; City Light Company, Hopkinsville, and the Bowling Green Gas Light Company, Bowling Green. All of the companies except that at Owensboro operate electric-light plants. H. C. Wood, the Rookery, Chicago, Ill., is interested in the enterprise, as well as Messrs. Kelsey & Brewer, of Grand Rapids, Mich. A New York house is stated to have reported on the engineering merits of the properties.

Important Electric Railway Legislation Foreshadowed.—The New England Investment & Security Company, which took over the street-railway properties in Massachusetts of which the New York, New Haven & Hartford Railroad Company had to divest itself a few years ago in consequence of a decision of the Supreme Court of Massachusetts, has filed a petition with the Secretary of State at Boston, Mass., for authority to sell its system to the New York, New Haven & Hartford Railroad Company. The company operates the trolley lines in the Berkshire, Springfield and Worcester district, and it is urged that New Haven ownership would secure a more systematic development of the property and industrial expansion of Worcester and Springfield.

To Combine Public Utilities in Southern Idaho.—J. S. & W. S. Kuhn, of Pittsburgh, who recently purchased the holdings of the Boise & Interurban Railway Company, operating a traction line between Boise and Caldwell, Idaho, as stated in these columns Oct. 21, have disposed of this company and their other interests in southern Idaho to a new company capitalized at $30,000,000 which has just been organized in Pittsburgh to effect a consolidation of all the water-power companies in southern Idaho and to acquire, develop and extend the properties of a number of lighting and traction companies in the section.

Financing Lehigh Coal Company's Electrical Project.—The Lehigh Coal & Navigation Company plans to issue $3,000,000 collateral trust 4½ per cent bonds for financing the electric plants it proposes to install at several of its mines in Pennsylvania for using waste coal as fuel and transmitting energy by high tension to various cities in Pennsylvania and New Jersey, as described in these columns March 16

DIVIDENDS.

Canadian Westinghouse Company, Ltd., quarterly, 1½ per cent and an extra dividend of 1 per cent, payable Jan. 10.

Chicago City Railway Company, quarterly, 2½ per cent and an extra dividend of 1½ per cent, payable Dec. 30.

Duluth Superior Traction Company, quarterly, preferred, 1 per cent; common, 1¼ per cent, both payable Jan. 2.

National Gas, Electric Light & Power Company, quarterly, preferred, 1½ per cent, payable Jan. 1.

Tri-City Railway & Light Company, quarterly, preferred, 1½ per cent, payable Jan. 2.

Twin City Rapid Transit Company, quarterly, preferred, 1¾ per cent; common, 1½ per cent, both payable Jan. 2.

REPORTS OF EARNINGS.

BLACKSTONE VALLEY GAS & ELECTRIC COMPANY.

Period.	Gross Earnings.	Operating Expenses.	Net Earnings.	Fixed Charges.	Net Surplus.
October, 1911.....	$97,473	$45,091	$52,382	$30,529	$21,853
October, 1910.....	92,366	47,488	44,878	30,238	14,640
CAPE BRETON ELECTRIC COMPANY, LTD.					
October, 1911.....	$31,650	$15,246	$16,404	$6,176	$10,228
October, 1910.....	30,496	13,447	17,049	6,161	10,888
COLUMBUS ELECTRIC COMPANY.					
October, 1911.....	$44,451	$21,071	$23,380	$14,850	$8,530
October, 1910.....	42,736	16,923	25,813	13,707	12,106
DALLAS ELECTRIC CORPORATION.					
October, 1911.....	$182,459	$100,848	$81,611	$29,547	$52,064
October, 1910.....	165,372	89,153	76,219	23,748	52,471
EL PASO ELECTRIC COMPANY.					
October, 1911.....	$62,011	$34,111	$27,900	$8,427	$19,473
October, 1910.....	55,172	32,919	22,253	8,224	14,029
GALVESTON-HOUSTON ELECTRIC COMPANY.					
October, 1911.....	$132,645	$76,728	$55,917	$25,547	$30,370
October, 1910.....	113,476	65,937	47,539	25,565	21,974
HOUGHTON COUNTY ELECTRIC LIGHT COMPANY.					
October, 1911.....	$26,200	$10,875	$15,325	$6,248	$9,077
October, 1910.....	24,572	11,415	13,157	4,553	8,604
JACKSONVILLE TRACTION COMPANY.					
October, 1911.....	$49,743	$25,691	$24,052	$12,488	$11,564
October, 1910.....	48,366	27,087	21,279	9,346	11,933
LOWELL ELECTRIC LIGHT CORPORATION.					
October, 1911.....	$32,332	$17,320	$15,012	$5,034	$9,978
October, 1910.....	38,256	21,534	16,722	4,236	12,486
NORTHERN TEXAS ELECTRIC COMPANY.					
October, 1911.....	$168,512	$78,517	$89,995	$25,010	$64,985
October, 1910.....	154,007	71,123	82,884	20,290	62,594
RUTLAND RAILWAY, LIGHT & POWER COMPANY.					
Year, Nov., 1911..	$314,581	$163,433	$151,147	$91,413	$59,733
Year, Nov., 1910..	274,874	144,396	130,477	85,701	44,776
SAVANNAH ELECTRIC COMPANY.					
October, 1911.....	$59,843	$41,302	$18,541	$18,536	$5
October, 1910.....	53,794	35,517	18,277	18,221	56
SEATTLE ELECTRIC COMPANY.					
October, 1911.....	$461,501	$260,383	$201,118	$115,934	$85,184
October, 1910.....	469,033	239,640	229,393	109,913	119,480
SIERRA-PACIFIC ELECTRIC COMPANY.					
October, 1911.....	$49,538	$18,837	$30,701	$4,441	$26,260
October, 1910.....	49,206	13,845	35,361	6,020	29,341
WHATCOM COUNTY (WASH.) RAILWAY & LIGHT COMPANY.					
October, 1911.....	$34,506	$18,099	$16,407	$6,770	$9,637
October, 1910.....	35,620	18,142	17,478	7,153	10,325

General News

Construction News.

BIRMINGHAM, ALA.—The promoters of the Tidewater Railway Company have submitted a proposition to the City Council offering to supply electricity for commercial and municipal lighting purposes, to begin not later than July 1, 1912. The company agrees to furnish electricity for lamps to private consumers at a flat rate of 10 cents per kw-hour with 10 per cent discount.

CROWN KING, ARIZ.—Plans are being considered by the Pacific Copper Company, which operates the Pacific copper mine, for the installation of electrical operating machinery at its properties.

PRESCOTT, ARIZ.—The Arizona Power Company is reported to be contemplating the erection of a new transmission line to the Copper Basin Mining district.

WEAVER, ARIZ.—Plans have been adopted by the Arizona Power Company for the extension of its electric transmission lines to a number of mines in the Weaver district. The proposed line will pass through the Copper Basin district and the Peeples Valley and will terminate at Alvarado. Weaver has not a post office.

LITTLE ROCK, ARK.—The Southwestern Telephone Company, with headquarters in Dallas, Tex., has taken over the Ft. Smith independent line and all the state exchanges, excepting Little Rock, owned by the Southern Telephone Company. The purchase of the Little Rock exchange is awaiting action by the Little Rock City Council before it can be closed.

BOCA, CAL.—The Union Ice Company is contemplating the installation of a large power plant. Water for operating the plant will be secured from the Little Truckee River. The cost of the plant complete is estimated at $1,500,000.

DORRIS, CAL.—The Siskiyou Electric Power & Light Company is building a new substation and electric-lighting system in Dorris. J. W. Churchill, of Yreka, Cal., is president of the company.

FELLOWS, CAL.—Plans are being prepared by the Kern Mutual Telephone Company for the construction of a new exchange building at Fellows. Business from Fellows and Shale, heretofore handled at Taft, will be cared for at the new station. J. T. Maguire is manager of the company.

FULLERTON, CAL.—Bids will be received by the trustees of the Fullerton Union High School until Dec. 22 for the construction of a group of school buildings, which will include an electric-power plant, central steam-heating plant and electric wiring. The work will involve an expenditure of about $130,000 exclusive of equipment. Norman F. Marsh, Broadway Central Building, Los Angeles, Cal., is architect.

HAMMONTON, CAL.—One of the gold dredgers, including electrical operating machinery, belonging to the Yuba Consolidated Goldfields Company was recently destroyed by fire, causing a loss of about $100,000.

HOT SPRINGS, CAL.—The Pine Flat Company, recently incorporated, contemplates the installation of an electric-light plant to supply electrical service in this district. G. E. and E. M. Alderson, of Los Angeles, are interested in the company.

KENNETT, CAL.—The Sacramento Valley Power Company has commenced work on the erection of a transmission line to the properties of the Standard Mining Company, a distance of about 8 miles.

LONG BEACH, CAL.—A petition has been presented to the City Council by the property owners on Pine Avenue from Ocean Avenue to Sixth Street, requesting the installation of ornamental lamps. The cost of the system is estimated at about $7,500.

LOS ANGELES, CAL.—The City Council has authorized the preparation of an ordinance to place Moneta Avenue from Thirty-seventh Street to Manchester Avenue in the conduit district, requiring the removal of all overhead lines.

LOS ANGELES, CAL.—The contract for the electrical work in the new I. N. Van Nuys office building, located at Seventh and Springs Streets, has been awarded to the Foulkes Electrical Company, Story Building, Los Angeles, Cal., at $20,350.

LOS ANGELES, CAL.—The Public Service Commission has passed favorably on the petition of the residents of Lone Pine for the installation of an electric-lighting system, securing electric energy for operating the system from the aqueduct power plants. Under the decision of the commission the town must bear the expense of installing the distributing system, transformers, meters, etc. E. F. Scattergood, chief electrical engineer of the power bureau, is in charge.

MODOC, CAL.—The Provident Investment Company, of Los Angeles, Cal., is planning to build an electric-light plant and distributing system in Modoc. A telephone system will also be installed. Modoc has not a post office. C. B. Zimmerman is in charge of the work.

OAKLAND, CAL.—The Southern Pacific Railroad Company has awarded a contract to the Rickson-Erhart Construction Company, 1859 Geary Street, San Francisco, Cal., for the erection of a cable tower at its Fruitvale power station, to cost $2,800.

OAKLAND, CAL.—The United Properties Company of California, recently incorporated at Wilmington, Del., has filed articles of incorporation at Sacramento, with a capital stock of $200,000,000. The company operates the Key Route electric railway system and plans the construction of a line from Oakland to Sacramento. The incorporators are: Frank Smith, C. B. Seabrushie, H. R. Ewart and H. W. Davis. The headquarters of the company are in Oakland.

REDWOOD CITY, CAL.—Plans are being considered for the installation of a new street-lighting system in the business district of the city. The Pacific Gas & Electric Company furnishes the street-lighting service in Redwood City.

RED BLUFF, CAL.—The Sierra Electric Power Company, recently incorporated with a capital stock of $3,000,000, has acquired a power site at Mill Creek, near Red Bluff, where it proposes to build a hydro-electric power plant. Charles Gross and E. A. Herman, of Oakland, Cal., are interested in the company.

RIVERSIDE, CAL.—The Pacific Electric Railway Company has been granted a franchise to construct and operate a double-track electric railway on Magnolia Avenue from Main and Fourteenth Streets to Arlington Avenue.

SACRAMENTO, CAL.—Bids will be received by M. J. Desmond, city clerk, until Dec. 26 for the installation of an electric freight and passenger elevator between O and P Streets in the city of Sacramento. Specifications are on file at the office of the city clerk.

SACRAMENTO, CAL.—The Retail Merchants' Association has awarded a contract for the installation of an electrolier street-lighting system on forty blocks in the main section of the city to J. C. Hobrecht, 1012 Tenth Street, Sacramento, Cal. Many merchants contemplate placing similar standards directly in front of their property.

SAN DIEGO, CAL.—Plans have been prepared by Superintendent Adams of the street department for the installation of ornamental street lamps in the entire downtown district. The contract for lighting Fifth Street from A to University Street will soon be awarded. Electric lamps suspended on the poles of the street railway company will be used on Fifth Street.

SAN FRANCISCO, CAL.—The Pacific Gas & Electric Company has taken over the plant and holdings of the Metropolitan Light & Power Company in this city. The consideration is said to be about $2,000,000. The plant of the Metropolitan company is located at North Beach.

SAN LEANDRO, CAL.—The Town Trustees will soon call a special election to submit the proposition to issue bonds to the amount of $40,000 for the installation of a fire-alarm system and fire-fighting appliances to a vote of the people.

SANTA ANA, CAL.—The Board of City Trustees has appointed a committee to take charge of the installation of an ornamental street-lighting system in the business district. The cluster-lamp system will be used.

CRIPPLE CREEK, COL.—A trust deed has been filed for record in Cripple Creek conveying the franchises of the local light and power plant in Teller, Fremont and Pueblo Counties, the Colorado Light & Power Company and the Suburban Light & Power Company to the Arkansas Valley Light & Power Company.

WALSENBURG, COL.—The Southern Electric & Traction Company has awarded the contract for the construction of a large power house at Walsenburg to Fox & Smith. The cost of the plant complete is estimated at $75,000. The power plant at Hastings has been taken over by the traction company, which owns and operates the Trinidad street railway.

HARTFORD, CONN.—The Hartford Electric Light Company has made a reduction in its maximum rate for electricity for lamps of 1 cent per kw-hour, to take effect from Dec. 1. The rate has been reduced from 10 cents to 9 cents per kw-hour.

SIMSBURY, CONN.—The Simsbury Electric Light Company is extending its system to the village of Weatogue for the purpose of supplying electrical service in that village.

WESTBROOK, CONN.—The citizens have voted to enter into a contract with the Essex Light & Power Company for street lighting for a period of five years. Under the terms of the contract the company is to furnish forty 40-cp incandescent lamps in this village.

WASHINGTON, D. C.—Proposals will be received at the office of the Commissioners of the District of Columbia, Washington, D. C., until Dec. 18 for furnishing and installing a complete electric-lighting system in the James Ormand Wilson Normal School Building, No. 162, Washington, D. C.; also for heating, ventilating and electric generating system in same building. Forms of proposals, specifications and other information may be obtained from the chief clerk, Engineer Department, Room 427, District Building, Washington, D. C.

CHICORA, FLA.—The Amalgamated Phosphate Company is reported to be contemplating the installation of an electric-light plant at its mines.

FT. DADE, FLA.—The contract for the installation of new boilers to operate the electric-light plant and water-works system of the reservation has been awarded to the E. Keller Company, of Williamsport, Va., at about $5,000. The A. M. Lockett Company, of New Orleans, La., secured the contract for installing the pumps and for supplying water for the reservation at a cost of $9,200.

JACKSONVILLE, FLA.—The Sisal Hemp & Development Company, 58 Mutual Life Building, Jacksonville, Fla., is reported to be in the market for a 200-hp electrical equipment for rope and lath yarn mill and would like to receive prices on same.

TAMPA, FLA.—The directors of the Tampa Electric Company have voted to recommend that the capital stock of the company be increased from $1,700,000 to $1,870,000 at the annual meeting of the stockholders to be held Jan. 8, 1912.

WINTER HAVEN, FLA.—Preparations are being made for the erection of an electric-light plant in Winter Haven. The Town Council has granted a franchise to W. F. Boyd for the installation of a plant and erection of transmission lines.

ATLANTA, GA.—R. C. Turner, city electrician, has submitted a report to the committee of Council on electric and power control, in which he recommends that the city establish a power plant to supply electricity to certain buildings unless an agreement can be reached with the Georgia Railway & Electric Company whereby the city may secure a flat rate for all energy consumed. He also recommends that at the end of the present year the city's present contract with the company be annulled. He asks that the city demand a flat rate of 1½ cents per kw-hour for electricity for power purposes and 3 cents per kw-hour for lamps.

MANCHESTER, GA.—At an election held Dec. 5 the proposition to issue $15,000 in bonds, the proceeds to be used for the installation of a municipal electric-light plant, was carried.

GOODING, IDAHO.—The local substation owned by the Great Shoshone & Twin Falls Light & Power Company, of Twin Falls, Idaho, was recently destroyed by fire.

ILO, IDAHO.—The Grangeville Electric Light & Power Company, of Grangeville, Idaho, is installing an electric-light system in Ilo. An arc-lamp street lighting system will be installed.

MULLAN, IDAHO.—The National Mining Company is planning to install new electric motors at its property.

AURORA, ILL.—The Wheaton & Du Page Light & Power Company, which operates an electric-light and power system in Wheaton, Chicago and other points in Du Page County, is contemplating the erection of a transmission line into North Aurora. Applications have already been made for franchises in Batavia and Aurora Townships and to the Village Board of North Aurora to erect the line.

CHICAGO, ILL.—The deal for the purchase of the Interstate Telephone & Telegraph Company by the Illinois Tunnel and the Chicago Subway Companies has been completed. Extensive improvements will be made to the system.

CHICAGO, ILL.—Sealed bids will be received by the city of Chicago until Dec. 18, Room 406, City Hall, Chicago, Ill., for furnishing and installing complete in the Roseland pumping station two turbo-generator units, complete with appurtenances and accessories, including steam and exhaust piping foundations and pipe trenches, according to plans and specifications on file in the office of the Department of Public Works. L. E. McGann is commissioner of public works.

COLCHESTER, ILL.—The plant and holdings of the Colchester Electric Light & Power Company have been purchased by Harry R. Moore and J. Highland, of Chicago, Ill. The new owners have been granted a twenty-year franchise by the Council. It is said that a new plant will be built, work on which will begin at once.

WILLIAMSFIELD, ILL.—Application has been made to the Village Board by E. J. Le Hew, of Galesburg, Ill., for a twenty-year franchise to install and operate an electric-light plant. It is proposed to erect a steam-driven plant, to cost about $6,000.

ARCADIA, IND.—The local electric-light plant, owned by the Noblesville Light, Heat & Power Company, was destroyed by fire recently, causing a loss of about $3,000.

FAIRMOUNT, IND.—The local electric-light plant owned by the Central Indiana Lighting Company has been purchased by the Marion Light & Heating Company, of Marion, Ind.

BOONE, IA.—Work has commenced on the extension of the heating system of the Boone Electric Company. The cost of the work is estimated at about $20,000.

DES MOINES, IA.—The Ft. Dodge, Des Moines & Southern Railway Company is reported to have purchased the abandoned Newton & Northwestern Railroad, which it proposes to equip for electrical operation.

DES MOINES, IA.—The Des Moines River Power Company has applied to the Department of the Interior for permission to improve the Des Moines River between Des Moines and Keokuk for power purposes and to make the stream available for canal purposes. The company asks for a seventy-five-year grant and for permission to construct a series of fourteen dams between Des Moines and Keokuk. The proposed work would involve an expenditure of about $7,000,000 and would make the stream available for purposes of navigation, save that it would be necessary to construct canals about the dams. The company does not propose to build the canals, leaving this to be done by the government when it gets ready to utilize the stream for navigation purposes. It is estimated that 25,000 hp can be developed.

GLIDDEN, IA.—The Council has awarded the contract for the construction of the power house for the proposed municipal electric-light plant, to cost about $1,700.

HAMPTON, IA.—The Commercial Club has adopted a resolution recommending the purchase of the Hampton Electric Light & Power Company by the city. The proposed plan will involve an expenditure of about $30,000. The proposition will probably be submitted to a vote of the people.

HITEMAN, IA.—The Independent Order of Odd Fellows Lodge has passed a resolution to install a power plant and will supply electricity to residents desiring it.

JEWELL, IA.—A petition has been prepared by the residents of the city which will be presented to the City Council asking that a special election be called to vote on the proposition to issue bonds for the construction of a municipal electric light and power plant in Jewell.

LEGRAND, IA.—The installation of an electric-light plant in Legrand is reported to be under consideration.

MOUNT PLEASANT, IA.—The Iowa Power Company, which operates a hydroelectric power plant at Oakland, has submitted a proposition offering to furnish the city with energy to operate the municipal electric plant at the rate of 2.7 cents per kw-hour for a period of ten years. The Council some time ago rejected an offer made by the company to supply the service at 3 cents per kw-hour for the first five years and 2.5 cents per kw-hour for the second five years.

OAKLAND, IA.—The Iowa Power Company has submitted a proposition to the Council offering to supply electricity to light the city.

OSKALOOSA, IA.—Plans are being prepared by the Oskaloosa Traction & Light Company for the erection of an electric transmission line from Oskaloosa to New Sharon, a distance of about 12 miles.

SLATER, IA.—It is reported that a committee has been appointed to make investigations pertaining to the installation of an ornamental street-lighting system.

VILLISCA, IA.—The proposition to grant a franchise to the Lee Electric Light Company, of Clarinda, Ia., to erect an electric-light and power plant in Villisca will probably be submitted to a vote of the people. Rufus E. Lee, of Clarinda, is secretary and manager of the company.

HUTCHINSON, KAN.—Extensive improvements are contemplated by the Santa Fé Railway Company in East Hutchinson, which will involve an expenditure of about $250,000 and include a round house, machine shop, power house, etc.

KANSAS CITY, KAN.—The contract for furnishing materials for and erecting upon foundations furnished by the city an arc-lamp equipment and furnishing 450 arc lamps has been awarded to the Stave Electrical Company, of Chicago, Ill., for $22,212.

LEAVENWORTH, KAN.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Dec. 22 for installing electric wiring and a conduit system including lamps in the government building in Leavenworth, Kan.

McCUNE, KAN.—The installation of an electric-light plant in McCune is reported to be under consideration.

CADIZ, KY.—Alexander Brothers, of Cadiz, Ky., who were recently granted a franchise to install an electric-light plant in this town, will, it is understood, soon begin work on it. The plant will be operated in connection with their ice factory.

FALMOUTH, KY.—The Council, it is reported, has engaged Anderson & Frankel, of Lexington, Ky., engineers, to take charge of the engineering work in connection with the proposed electric-light plant, for which bonds to the amount of $7,500 were recently voted. N. C. Ridgeway is Mayor.

LOUISVILLE, KY.—It is reported that surveys are being made by H. M. Byllesby & Company, of Chicago, Ill., at Cumberland Falls, in Whitley County, about 110 miles from Louisville, Ky., with a view of establishing a hydroelectric power plant to supply electricity in Louisville and other cities.

LOUISVILLE, KY.—Bids will be received by the Commissioners of Hospital, 312 Columbia Building, Louisville, Ky., until Jan. 4 for erection of the Louisville Public Hospital, to cost about $900,000. Bids will be received for the construction of building complete; also for complete mechanical equipment, including electric work, power-plant machinery, heating, ventilating, elevators, laundry machinery, sterilizing apparatus, gas piping, etc. Plans and specifications can be seen at the office of the Commissioners of Hospital or at the office of D. X. Murphy & Brother, of Louisville, Ky., architects. John H. Leathers is chairman.

UNIONTOWN, KY.—The Home Lighting Company, it is reported, is planning to remodel its electric-light plant. The company is erecting a new building and will install two 125-hp boilers, generators and other machinery. G. W. Clements is manager.

WHITESBURG, KY.—Plans have been completed by D. C. Mullins & Son, of Partridge, Ky., for the installation of an electric light and power plant in Whitesburg, work on which will begin at once.

LAFAYETTE, LA.—The City Council is considering the question of issuing bonds to the amount of $50,000, the proceeds to be used for improvements and extensions to the municipal electric-light plant and water-works system.

RAYVILLE, LA.—It is reported that the Council has engaged W. H. Wright to prepare plans for an electric-light plant.

PORTLAND, MAINE.—Arrangements are being made by the Portland Light & Power Company for the construction of a substation, to be located on Hooper Street, between Sewall and Davis Streets, for distributing electric energy received from the hydroelectric plants at Bonny Eagle, West Buxton and North Gorham stations. The building will cost $40,000 and the initial equipment $60,000. Later the equipment will be duplicated, making the total cost of the station $160,000.

FREDERICK, MD.—Plans are being considered by parties who control the electric-railway properties and electric-power plants in Hagerstown and Frederick for securing electric energy from the large electric plant in Millville, on the Shenandoah River, above Harper's Ferry, W. Va., for operating the electric-railway systems and for lamps and motors throughout the territory in which they operate. Electricity will be distributed by the Frederick Gas & Electric Company, which is controlled by the Frederick Railroad Company.

BOSTON, MASS.—Plans have been prepared by the Boston Elevated Railway Company for the construction of a new substation for the Malden terminus of the proposed elevated railway from Sullivan Square to Malden.

CHARLTON, MASS.—The Webster & Southbridge Gas & Electric Company, of Webster, Mass., is preparing plans for the extension of its commercial lighting system into the center of Charlton, Mass. The company will soon supply electricity at the Masonic Home at Overlook for lamps, motors and pumping service. A number of mills, residences, etc., which are at present supplied with current by the local street-railway system as a matter of accommodation only, will be connected with the lighting company's circuits. If the patronage demands it, a substation will be erected at Charlton.

FALL RIVER, MASS.—Plans are being considered for the installation of an electric-light plant which will provide electricity for lighting the building of the State leper colony on Perikese Island, and to furnish power for operating the wireless-telegraph system. The cost of the proposed plant is estimated at $1,200.

FOXBORO, MASS.—The Norfolk & Bristol Street Railway Company is planning to purchase a 250-hp or 300-hp boiler for its power plant.

HOLDEN, MASS.—An agreement has been reached between the Selectmen of Holden, Mass., and the Connecticut River Transmission Company whereby the town will be lighted by electricity to be supplied from the West Boylston substation. About eighty 40-watt tungsten street lamps will be installed.

HYANNIS, MASS.—The Hyannis Lighting Company has installed its temporary lighting plant in the rear of John S. Blagdon's shop on Sea Street.

MILFORD, MASS.—The Standard Raincoat Company has acquired the M. F. Green factory, located at Northboro and Jefferson Streets, and will erect a new brick power station in connection with the property.

READING, MASS.—The Reading Municipal Electric Light Board has announced a reduction in the price of electricity for lamps and heating service, the new schedule to take effect from Dec. 7. The new rates are 12 cents per kw-hour for electricity for lamps and 4 cents per kw-hour for heating. The old rates were 15 cents per kw-hour for lamps and 6 cents for heating purposes. The minimum charge for lamps will be $1 per month, except during May to August inclusive, when the charge will be 50 cents per month. New rates are also announced for the towns of Lynnfield Center and North Reading, which are served by the Reading plant. These communities benefit by a 25 per cent reduction from former rates, the new prices being 15 cents per kw-hour for lamps and 4 cents for heating. New lines have been extended from the plant to Wilmington, which will be ready to supply electrical service on Jan. 1. The plant will also continue to furnish a twenty-four-hour service to the town of Wakefield during the coming year.

SOUTH DEERFIELD, MASS.—The Greenfield Electric Light & Power Company has purchased the electric-light plant in South Deerfield owned by J. B. Bridges & Company, and took possession of the plant Dec. 1. The Greenfield company proposes to replace the present poles with heavier ones, using the same poles for both electric and telephone wires.

WORCESTER, MASS.—The New England Corset Company has purchased a factory building in Worcester and is planning to install a power plant. The company contemplates an expenditure of about $10,000.

GRAND RAPIDS, MICH.—The Eastern Michigan Power Company has been granted permits to erect two substations in Grand Rapids, one to be located on Hall Street and the other on Wealthy Avenue, to cost $1,100 each.

HARTFORD, MICH.—Anderson Brothers, owners of the local electric-light plant, will probably apply for a franchise in Hartford, which may be submitted to the voters at the election next spring. It is proposed to make important improvements to the power plant, located at the Anderson mill, 1 mile north of the village, which will provide for a twenty-four-hour service. The firm is at present operating in Hartford practically without a franchise and has been doing so since the establishment of the plant thirteen years ago.

HASTINGS, MICH.—Plans are being considered for the construction of a dam 8 ft. high in the Thornapple River above the city. This improvement, it is said, would increase the water-power by at least 800 hp.

JACKSON, MICH.—The Commonwealth Power Company has applied to the State Railroad Commission for permission to issue $1,860,000 in bonds, of which the proceeds are to be used for improvements and extensions to the following plants: For the Saginaw Power Company, $90,000; Bay City Power Company, $27,000; Pontiac Power Company, $36,000; Flint Power Company, $54,000; Commonwealth Power Company, Jackson, $72,000; Grand Rapids-Muskegon Power Company, $450,000; Consumers' Power Company, of Owosso, $36,000, and $1,080,000 to refund a bond issue of the Grand Rapids Edison Company due in 1916, and $15,000 to refund an issue of the Lowell water plant due in the near future.

KALAMAZOO, MICH.—The special lighting committee of the City Council has asked the city engineer to prepare estimates of the cost of erecting ornamental lamp-posts on Burdick Street from the Michigan Central tracks to Lovell Street, on Rose Street for the same distance, on Main Street from the Lake Shore tracks to West Street, on South Street from Portage to Park Street, on the streets around Bronson Park, on Water Street from Rose to Edwards Street, on Edwards Street from Water to Main Street, and on Kalamazoo Avenue from Rose to Burdick Street.

MENDON, MICH.—It is reported that Seiver Brothers, of Burr Oak, Mich., have submitted a proposition to the Council offering to purchase the municipal electric-light plant and equipment, including Parkville dam, for $11,085, provided the town of Mendon will grant them a thirty-year franchise and a contract to light the town for a period of ten years. They agree to sell the plant to the town at the expiration of the franchise at a price to be agreed upon by experts. The town purchased the Parkville property in 1908, for which $10,000 was appropriated. It was proposed to utilize the power to operate the municipal electric plant, but the appropriation was not sufficient to carry out the project.

MENOMINEE, MICH.—The Menominee & Marinette Light & Traction Company has awarded the contract for the installation of the new generator at its plant in Ingalls to the General Electric Company. The Dayton Globe Iron Works, of Dayton, Ohio, secured the contract for the waterwheel. Contract for transformer and switchboard apparatus was awarded to the Westinghouse Electric & Manufacturing Company. The improvements to the plant will involve an expenditure of about $25,000.

STEVENSVILLE, MICH.—Plans are being considered for the installation of an electric-light system in Stevensville. Mr. Aimes, of St. Joseph, is interested in the project.

RED WING, MINN.—The Red Wing Gas Light & Power Company is reported to have been asked to submit a proposition for lighting the streets of the city under a new contract, including cluster lamps.

ROCHESTER, MINN.—It is reported that J. H. Sonntag and O. C. Decker are negotiating for the purchase of the municipal electric-light plant. Mr. Decker is president of the Rochester Light, Heat & Power Company.

TWO HARBORS, MINN.—Sealed bids will be received by Aug. Omtvedt, city clerk, Two Harbors, Minn., until Dec. 19 for furnishing and installing in the municipal water and light plant one 300-kw, 60-cycle, single-phase or two-phase electric generating unit. Proposals will be considered for a direct-connected engine and generator, also for a belt-driven unit, the engine to be condensing without condenser. Plans and specifications are on file in the office of the city clerk.

VIRGINIA, MINN.—The City Council has decided to engage Burns & McDonnell, of Kansas City, Mo., to make an appraisal of the electric and water plants of the Virginia Electric & Water Company, which is to be taken over by the city. The Council will appoint a committee of five to recommend to the judges of the district court the names of the freeholders as appraisers in condemnation proceedings.

WATERVILLE, MINN.—The City Council has granted the Consumers' Power Company, of Mankato, Minn., a franchise to construct and operate an electric-light plant in Waterville.

WINONA, MINN.—The Twentieth Century Transportation Company is planning to build power houses at Lancaster, Wis., and Watertown, S. D., in the spring to supply electricity to operate its proposed railway.

RICHTON, MISS.—The Richton Light & Power Company, it is said, is planning to build a new power house.

GRANDVIEW, MO.—It is reported that the installation of waterworks, sewer and lighting systems in Grandview is under consideration. J. E. Fred is said to be interested in the project.

KING CITY, MO.—At an election held recently the proposition to issue bonds for the installation of a municipal electric-light plant is reported to have been carried.

ST. LOUIS, MO.—Application has been made to the St. Louis County Court for a fifty-year franchise by David P. Leahy, Richard P. Baldwin and Philip A. Smith to erect transmission lines through St. Ferdinand and Central Townships. It is proposed to erect a power plant in Jennings for the purpose of supplying electricity in different parts of the country.

TRENTON, MO.—The controlling interest of the Citizens' Gas & Electric Company, of Trenton, Mo., has been acquired by Burdette L. Browne, of Pontiac, Mich., who, it is said, will make extensive improvements to the plant.

BUTTE, MONT.—Plans are being considered to equip the railway system of the Butte, Anaconda & Pacific Railway Company for electrical operation, the cost of which is estimated at about $1,000,000. The system is operated by the Anaconda Copper Mining Company.

LEWISTON, MONT.—The Mountain States Telephone & Telegraph Company has acquired the plant and holdings of the Mutual Telephone Company, of Lewiston, Mont., for $150,000. Many improvements will be made to the system and a new exchange built. The Mountain States company will soon begin work on the erection of a telephone line from Judith Gap to Broadview, Mont., a distance of 100 miles. District Manager Owens, of Billings, Mont., will have charge of the work.

OMAHA, NEB.—The contract for furnishing and installing lighting fixtures for the new county building has been awarded to Hayden Brothers at $25,000.

OMAHA, NEB.—Plans are being considered by the Nebraska Transportation Company for the construction of a new power plant at Elk City. The proposed plant will have an output of 21,000 hp.

STANTON, NEB.—The City Council has decided to make extensions and improvements to the municipal electric plant, including the erection of an addition to the present power house and the installation of a 100-hp steam engine and 125-hp boiler and new generator. The gas engine now in use will be held for use in emergencies. C. A. Hickman, consulting engineer, is in charge of the engineering work.

WINNEMUCCA, NEV.—Plans are being considered by the Continental Lake Irrigation Company for the erection of a telephone line from Wild Horse, Ore., to Winnemucca. E. B. Hill is manager.

ANDOVER, N. J.—The electric-light plant owned by Samuel S. Willis was destroyed by fire on Dec. 7, causing a loss of about $14,000. It is understood that the plant will not be rebuilt.

FINDERNE, N. J.—The H. W. Johns-Manville Company, manufacturer of asbestos and roofing products, is reported to have acquired about 290 acres in Finderne, N. J., where it proposes to build factory buildings and about 200 houses for its employees. It is understood that the company will merge its three factories now located in South Brooklyn and Newark under one roof. The cost of the enterprise is estimated at about $2,000,000 and will include a power plant costing about $200,000. The executive offices of the company are located at 100 William Street, New York, N. Y.

FREEHOLD, N. J.—The Manalapan Light Company has been reorganized under the name of the Monmouth Light Company, with Nelson B. Hazeltine, of Philadelphia, Pa., president. The power plant is located at Englishtown. The new company proposes to increase the output of the plant and extend its transmission lines.

ROSWELL, N. M.—The Roswell Gas & Electric Company will soon complete the installation of its new power plant and the erection of its transmission system to the farms in this section. The transmission lines aggregate about 80 miles of cable and will furnish electricity to operate many irrigating pumping plants. The cost of the plant complete will be about $350,000.

SANTA RITA, N. M.—The Chino Copper Company has begun work on the installation of a large central electric-power plant at its mines.

ALBANY, N. Y.—It is reported that the Municipal Gas Company contemplates increasing its capital stock from $2,000,000 to $6,250,000.

BUFFALO, N. Y.—Orders have been placed by the Buffalo, Rochester & Pittsburgh Railroad Company with the Western Electric Company for telephone equipment for train dispatching over two divisions of its system. One of these will extend from Rochester, N. Y., to East Salamanca, N. Y., a distance of 110 miles, and the other from Buffalo, N. Y., to East Salamanca, a distance of bout 65 miles.

EASTPORT, N. Y.—The Southampton Town Board has granted the application of the residents of Eastport to establish a lighting district. A contract has been closed with the East Patchogue Electric Light Company to supply electricity for the service.

ITHACA, N. Y.—A committee has been appointed by the Business Men's Association to investigate the cost of installing an ornamental street-lighting system in Ithaca.

KEESEVILLE, N. Y.—The Public Service Commission, Second District, has authorized the Keeseville Electric Company to execute a mortgage on its property for $500,000. The company is also authorized to issue $70,000 in bonds, of which the proceeds of $30,000 are to be used to take up existing bonds at par, and the remaining $40,000 for the construction of a transmission line to Ausable Forks from Ausable Chasm and local lines in Ausable Forks, and for electrical equipment and improvements to its power house.

NEW YORK, N. Y.—Bids will be received by the Department of Public Charities until Dec. 21 as follows: (1) For furnishing materials and labor for underground-conduit system, transformer vault, electric elevator and other work in the metropolitan hospital district; (2) for complete electric wiring and fixtures for infirmary dining-room and kitchen, female tuberculosis building and sun tents, solarium pavilions Nos. 1 to 5, superintendent's residence, carpenter shop, coffin shop, stable, power house and laundry building for metropolitan hospital district; (3) for complete electric wiring and fixtures for new Roman Catholic church, male infirmary and sun tents, and electric motors for laundry for metropolitan hospital district; (4) for furnishing labor for ground wire and labor and materials for grounding system, lightning arresters and automatic switches for metropolitan hospital district. Blank forms and further information may be obtained at the office of Frank Sutton, consulting engineer, 80 Broadway, New York, N. Y., where plans and specifications may be seen. Michael J. Drummond is commissioner.

RICHFIELD SPRINGS, N. Y.—The Public Service Commission has authorized the Richfield Springs Utility Company to purchase the plant and distributing system of the Richfield Springs Electric Light & Power Company and to increase its capital stock to $20,000. The company is also authorized to execute a mortgage upon all its property and franchises to secure an authorized issue of $100,000 in bonds. The commission has given the company authority to issue capital stock to the amount of $13,600 and bonds to the amount of $34,000, to be sold at not less than 85, the proceeds to be used for the purchase of properties at Richfield Springs and the rehabilitation of same.

ROCHESTER, N. Y.—The Rochester Railway & Light Company is planning to erect a transmission line from the Float Bridge power house to Webster to connect with the lines of the Sodus Gas & Electric Light Company.

ROCHESTER, N. Y.—Plans have been completed for the erection of a transmission line to tap the system of the Rochester Railway & Lighting Company in Plymouth Avenue to supply electricity to the Iola Sanatorium. In addition to providing energy for lamps and motors, electricity will be used for charging the air with ozone in several of the hospital wards. The transmission line will be 3 miles long.

UTICA, N. Y.—The Board of Contract and Supply has directed Stuart F. Day, secretary, to advertise for bids for lighting the streets of the city for a period of one, three and five years, according to specifications filed with the city engineer and commissioner of public works. Bids will be received until Dec. 13.

UTICA, N. Y.—Preparations are being made by the Utica Gas & Electric Company for the erection of a transmission line from its plant at Trenton Falls direct to Rome to supply that city with electricity. Under the new arrangements it will be possible to furnish energy both to Rome and Utica over either of the two transmission lines. Surveys have been made for the new line.

CINCINNATI, OHIO.—The City Council has notified the director of service to instruct the Union Gas & Electric Company to extend its transmission lines and install the new type of street lamps on Reading Road, from McMillan to Paddock Road; on Madison Road, from Observatory Avenue to Williams Avenue, and from the east corporation line of Oakley to Deerfield Road; on Montgomery Road, from Blair Avenue to the Norfolk & Western Railroad; on Ohio Pike, from Beechmont Avenue to Mount Washington, and on Hillside Avenue, from Anderson's Ferry Road to the corporation line.

CLEVELAND, OHIO.—The Cleveland Electric Illuminating Company has applied to the City Council for a franchise to extend its hot-water and steam-heating system in the downtown section of the city in the vicinity of Euclid Avenue and East Fifty-fifth Street.

IRONTON, OHIO.—Plans are being considered for the consolidation of the electric operating companies under the name of the Ironton Electric Company. Application has been made to the Public Service Commission for permission to take over the property of the Ohio Valley Electric Railway Company and for approval of an issue of additional securities to consummate the deal.

LETART FALLS, OHIO.—A company has been formed with a capital stock of $3,000,000, which will eventually be raised to $15,000,000, for the purpose of building a dam across the Ohio River at Letart Falls, in Meigs County, and the construction of a large power plant to supply electricity for all towns in southern Ohio, including Cincinnati and Columbus. The company, it is said, proposes to construct a series of locks in the river that will make the river navigable. James M. Ashley, of Toledo, Ohio, has been elected president of the company. The office of the company will be located at 165 Broadway, New York, N. Y.

LIMA, OHIO.—A franchise has been granted to W. Kesley Schoepf, president of the Ohio Electric Railway Company, for the extension of the Fourth Street line in Lima to reach the Gramm motor-car works.

LYNN, OHIO.—Plans are being considered by the Merchants' Association, the Board of Trade and the Municipal Council for the installation of an ornamental street-lighting system on the principal streets of the center of the city. It is proposed to use the cluster lamp system.

PAINESVILLE, OHIO.—The city has decided to continue to generate electricity at the municipal electric plant, instead of purchasing it from the Cleveland, Painesville & Eastern Railroad Company. The company submitted a proposition offering to supply the service on a sliding scale, ranging from 2.5 cents per kilowatt to 1.9 cents per kilowatt for all energy consumed above 30,000 kw per month. On the basis of the amount now used by the city, electricity used under this offer would have cost 2.27 cents per kilowatt. The new rate for electricity to consumers is to be 7 cents per kw-hour.

TOLEDO, OHIO.—Plans have been prepared by Schenck & Williams, architects, for the large power building of the Toledo Factories' Company, which is to supply power and plant facilities for new industries in Toledo. Bids have already been received by the architect for the building. Isaac Kinsey is one of the promoters.

TOLEDO, OHIO.—Estimates have been submitted by Service Director Cowell to the City Council of the cost for the installation of

a high-pressure pumping station provided with such equipment that in the future it will be possible to use it to generate electricity. The cost of the plant is estimated at $214,000, exclusive of the site, which will cost $23,000 additional. The report also recommends the employment of a designing engineer to prepare detail plans for the station. According to tentative plans, which have been approved by the Board of Control and the water-works superintendent, the station for the present will maintain a capacity of 4800 gal. per minute. Its maximum capacity will be 9600 gal. per minute. Gas-engine equipment is recommended.

HOBART, OKLA.—The plant and holdings of the Hobart Light & Power Company were sold Nov. 28 to W. S. Hiff, of Denver, Col., at a foreclosure sale, for $85,500.

SULPHUR, OKLA.—The Rapid Transit Interurban Company, it is reported, is considering plans for the installation of a power plant to supply electricity for operating its railway and for lamps and motors to residents along the route. J. W. Saxon, of Tecumseh, Okla., is president of the company, and Edgar M. Graham, of Muskogee, Okla., chief engineer.

BEND, ORE.—Plans are being considered by the Bend Water, Light & Power Company for the installation of new magnetite arc lamps in certain sections of the city.

LA GRANDE, ORE.—Plans are being considered by the Eastern Oregon Light & Power Company, of Baker City, Ore., for the installation of electric pumping machinery in the Grand Ronde district.

PANAMA.—Sealed proposals will be received at the office of the general purchasing officer, Isthmian Canal Commission, Washington, D. C., until Jan. 6 for furnishing miscellaneous material for rack railway and miter gates, including track bonds, flexible and solid conduit fittings, steel splice bars, brass pins, sheet asbestos pads, etc. Blanks and general information relating to this circular may be obtained at the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and 1086 North Point Street, San Francisco, Cal. Major F. C. Boggs is general purchasing officer.

PHILADELPHIA, PA.—The Philadelphia Electric Company has announced a reduction in its price of electricity for lamps from 15 cents to 12 cents per kw-hour in the central business district of the city, to take effect from Jan. 1, 1912.

READING, PA.—Notice has been filed with the State Department of the sale of seven electric companies operating in Berks County, recently chartered, each with a capital stock of $5,000, to the Metropolitan Electric Company, of Reading, Pa.

PROVIDENCE, R. I.—Radical changes in the lighting system are recommended in the report submitted to the City Council by Prof. William D. Marks, illuminating engineer, engaged by the Council to investigate the city's lighting franchise and lighting system. Among the recommendations made in the report are: The substitution of 60-cp tungsten lamps for the 32-cp tungstens now in use; locating about 1000 6.6-amp magnetite arc lamps on streets where there are no trees; removal of arc lamps from tree-shaded streets; removal of arc lamps from high poles where they are shaded by foliage and the substitution of incandescent lamps, to be placed on iron or wooden posts in residential sections; the introduction of the 6.6-amp direct-current system; the use of newer forms of flaming-arc lamps with 10-amp current for open spaces demanding brilliant illumination; the spectacular and brilliant illumination of Exchange Place for the purpose of testing the public demand for such illumination; cutting down the number of incandescent lamps on the bridges and substituting magnetite arc lamps at each end of each bridge draw, with the centers of each draw lighted by a pair of large tungsten lamps of 350 cp each; a change in the system of commercial-rate charges based on the quantity consumed, regardless of the capacity or time of use of private installations of connected light or power, to the method of charge based on the hours of use, and the appointment of a municipal illuminating engineer.

MOBRIDGE, S. D.—Bids will be received by M. T. Woods, city auditor, until Dec. 18 for 6-in. pipe to connect the main to the power house and return.

MOUNT VERNON, S. D.—Plans are being considered for the installation of a new electric-lighting system in Mount Vernon.

GLEASON, TENN.—The Gleason Water Company, it is said, is contemplating the installation of an electric-light plant in Gleason. Equipment for the plant will be purchased at once. The company has increased its capital stock from $3,500 to $7,000. Dr. J. C. Ammons is secretary.

JACKSON, TENN.—Preparations are being made by the Jackson Railway & Light Company for extensions and improvements to its system, which will involve an expenditure of about $30,000. A contract has been awarded to the Allis-Chalmers Company, of Milwaukee, Wis., for the installation of a 1000-kw generator. John Windom is superintendent.

PARKSVILLE, TENN.—The Eastern Tennessee Power Company, which is completing a hydroelectric project on the Ocoee River, near Parksville, Tenn., is reported to be considering the construction of another dam farther up the river, which will increase the available power to 60,000 hp.

GRAND SALINE, TEX.—The local electric-light plant was recently destroyed by fire, causing a loss of about $5,000. It is understood that the plant will be rebuilt.

LONE OAK, TEX.—It is reported that a franchise has been granted to W. J. and J. C. Ross and J. R. Simpson, all of Kaufman, Tex., to construct and operate an electric-light plant and water-works system in Lone Oak. The cost of the equipment is estimated at $10,000, for which orders have already been placed.

SLATON, TEX.—The Commercial Club is promoting the installation of an electric-light plant in Slaton. It is also making arrangements for the establishment of an ice factory.

GREEN RIVER, UTAH.—Negotiations are under way by Twin Falls, Idaho, capitalists for using the surplus water-power at the plant of the Green River Irrigation Company, where 450 hp goes to waste after the water is distributed over 5000 acres by this system. It is proposed to utilize the power to generate electricity which will be distributed throughout the entire valley, as well as to furnish electricity for lamps and motors in this city. Eventually a water-works system will be established.

SALT LAKE CITY, UTAH.—A permit has been taken out by the Auerbach Company to build a large power plant to be used in connection with its new department store on East Second Street.

RUTLAND, VT.—The Clarendon Power Company has applied to the Public Service Commission for permission to increase its common stock, preferred stock and its bond issue to $1,000,000 each, in order to provide sufficient funds to develop a hydroelectric power plant to furnish electricity to adjacent towns in Rutland County.

ATTALIA, WASH.—Negotiations have been completed by the Pacific Power & Light Company for right-of-way for its proposed main transmission line to the transformer station in Attalia, also for its line to Wallula, 3 miles distant, where the company proposes to supply electricity for lamps and motors.

CONCONULLY, WASH.—The Reclamation Service is reported to be preparing plans for the construction of a hydroelectric power plant on the Salmon River, with an electric distributing system in the Okanogan district, in connection with its reclamation project in this territory.

OLYMPIA, WASH.—Plans are being considered for increasing the generating capacity of the electric-light plant in the Young Men's Christian Association building. It is understood that a new lighting system will be installed.

SEATTLE, WASH.—Borings have been started in the Cedar River Valley preliminary to the preparation of plans for the city's new power dam to cost $1,400,000. Surveys are also being made to determine the cost of constructing a tunnel for the water-pipe line.

WASHTUCNA, WASH.—It is reported that plans are being prepared by L. Campbell for the construction of a hydroelectric power plant on the Adams River to supply electricity to operate his proposed flour-mill plant.

FOND DU LAC, WIS.—The Water Works Commission is contemplating the installation of an electric plant to supply electricity for lighting the plant. The installation of three additional boilers is also under consideration.

FT. D. A. RUSSELL, WYO.—Proposals will be received at the office of the constructing quartermaster, Ft. D. A. Russell, Wyo., until Dec. 22, 1911, for furnishing and installing an electric elevator. Further information furnished on application to the above office. Captain F. S. Armstrong is constructing quartermaster.

KAMLOOPS, B. C., CAN.—The City Council has passed a by-law appropriating $300,000 for the Barrier River project, which includes the following work: dam and intake, including pipe, trench, locks and gates and terminals, to cost $57,550; power house and two 1200-hp turbines and two 600-kw generators, $55,000; transmission lines, telephones, etc., 45 miles, $152,775, and for 1¼ miles of 6-ft. wood pipe, $29,700. Herman & Burwell and Dutch & Maxfield, of Vancouver, B. C., are engineers.

EXETER, ONT., CAN.—The Council has decided to submit a by-law to the ratepayers on the question of securing electricity from the Hydroelectric Power Commission for Exeter.

OTTAWA, ONT., CAN.—Plans are being considered by the City Council for improvements to the street-lighting system in Hintonburg, Mechanicsville, Ottawa East and Ottawa South, suburbs of the city. The Ottawa Electric Company has submitted a proposition to Superintendent Brown offering to install tungsten lamps in all the suburbs at $15 each per year. There are at present 151 lamps of small candle-power, averaging $8.48 each per year.

STRATFORD, ONT., CAN.—It is reported that plans have been prepared by the promoters of the London & Northwestern Radial Railway Company, which proposes to build an electric railway between London and Sarnia, for the construction of a dam on the Au Sable River, at Rock Glen, in West Williams, to provide power to generate electricity to operate its proposed electric railway.

PEARSON, CHIHUAHUA, MEX.—Plans are being considered by Dr. F. S. Pearson, of New York, N. Y., and associates, who own the Mexico Northwestern Railroad and extensive timber interests in this section, for the construction of an electric railway to extend from Pearson to Colonia Juarez. It is proposed to build a large power plant to furnish energy to operate the proposed railway and also to provide electricity to operate the large lumber mills and other industries which are being established in this district.

Personal.

MR. P. H. MORTON, Sand Point, Idaho, has been appointed manager of the Oregon Power Company, with headquarters at Albany, Ore.

MR. CHARLES W. STONE has been appointed to succeed the late Caryl D. Haskins as manager of the lighting department of the General Electric Company.

MR. JEAN BART BALCOMB, consulting electrical engineer, has been appointed executive engineer for the Alvord Irrigation Company, with headquarters at Alberson, Ore.

MR. DAVID FENNESSY, formerly manager of the Parral (Mexico) Power & Reduction Company, has accepted a position with the General Electric Company at El Paso, Tex.

MR. HENRY FLOY left for the South last week with a party of prominent engineers and financiers who are interested in a large irrigation and hydroelectric development.

MR. WILLIAM J. NORTON, of the Commonwealth Edison Company, Chicago, has been appointed secretary of the rate research committee of the National Electric Light Association.

MR. R. W. PUTZKER has been appointed manager of the Pacific Telephone & Telegraph Company, Marysville (Cal.) district. Mr. Putzker was formerly district manager for the company at Santa Cruz, Cal.

MR. JOHN S. NICHOLL, B.S., lately with the New York Edison Company and formerly acting manager for F. W. Horne, importer of American machinery, Yokohama, Japan, has joined the staff of Walter B. Snow, publicity engineer, Boston.

MR. SAMUEL H. GLUCROFT has resigned as consulting engineer and sales manager of the General Illuminating Company, New York, to become associated with the sales organization of the Helios Manufacturing Company, Philadelphia, Pa.

MR. SIDNEY G. KOON, M.M.E., has joined the staff of Walter B. Snow, publicity engineer, Boston. Mr. Koon was for four years editor of *International Marine Engineering* and later was metallurgist with the Jones & Laughlin Steel Company.

PROF. PHILIP S. BIEGLER, of the University of Montana, Missoula, Mont., is delivering a series of lectures on applied electricity to the employees of the Northern Pacific Railroad at Missoula. These lectures are in connection with the extension work being done by the School of Engineering of the university.

MR. RALPH BIRCHARD, formerly manager of the *Railway Electrical Engineer,* Chicago, has joined the staff of the Edison Storage Battery Company of Orange, N. J. Mr. Birchard is in the sales department at Orange, his duties including the preparation of bulletins covering the uses of the Edison battery.

MR. GEORGE D. LUTHER, who took part in the discussions at the meeting of the Boston Electric Vehicle Club on Nov. 15, is the representative at Denver, Col., of the Electric Storage Battery Company and not, as stated in the notice of the meeting in our issue of Nov. 25, of the Edison Storage Battery Company.

MR. HERBERT ALDEN SEYMOUR has been appointed editor of the *Edison Round Table,* which is the magazine published in Chicago by the Commonwealth Edison Section of the National Electric Light Association. Mr. Seymour has been editor of the *Electric City Magazine,* also a Commonwealth Edison publication, for several years.

MR. JAMES BRONIS, of West Orange, N. J., a member of the Illuminating Engineering Society, the National Sales Managers' Association and many fraternal organizations, and who has served in various capacities in the business development of the Moore Light Company during the past eight years, left that company on Dec. 15, to take up important work in a new organization.

MR. C. A. HAMILTON, who for the past six years has been vice-president and general manager of the Wisconsin Engine Company, Corliss, Wis., has resigned from that company to take an interest in the Lavigne Gear Company, a new corporation organized for the purpose of manufacturing automobile steering gears and accessories. Mr. Hamilton has been elected vice-president and general manager of this company, with general offices at Milwaukee, Wis.

MR. J. BOWYER, manager of the Anchor Cable Company, Ltd., of Leigh, Lancashire, England, is paying a flying visit to America to see what is being done in his line on this side of the Atlantic. Mr. Bowyer has been the guest of Mr. E. W. Stevenson, of Wilkes-Barre, Pa., a veteran in the insulated-wire business. After visiting several Eastern factories and inspecting the various plants where machinery and crude materials are supplied, Mr. Bowyer will return home in time for Christmas.

MR. GLENN MARSTON, of the Public Service Publishing Company, of Chicago, sailed Saturday, Dec. 9, on the steamship *Olympic* for a short investigating trip through England, Germany and France. Mr. Marston has made several former trips, and his present trip is for the purpose of studying the terms of the contracts which have been entered into by a number of municipalities whereby the municipal plants have been abandoned or leased to private power companies. In addition to his investigation in municipal ownership, Mr. Marston will act as representative for the 1912 Boston Electric Show, calling upon a number of British manufacturers who contemplate exhibiting at the show, which will be held from Sept. 28 to Oct. 26, 1912.

COL. EDWARD D. MEIER, president of the American Society of Mechanical Engineers, was presented with an illuminated address of congratulation at the May meeting of the society in Pittsburgh. At that time Colonel Meier consented to sit for his portrait, at the request of a number of the members, and this portrait was exhibited at the recent meeting of the society in New York and attracted much attention. Colonel Meier was born in St. Louis in 1841, and has an honorable Civil War record. He organized the Heine Safety Boiler Company in 1884, and is also accredited with being responsible for the introduction of the Diesel engine into this country. He is a past-president of the American Boiler Manufacturers' Association and of the Metal Trades Association. His home is in St. Louis.

MR. THOMAS E. MITTEN, president and director of the Chicago City Railway Company, and one of the leading street-railway executives of the country, resigned both his positions with the Chicago company on Dec. 14. In his letter of resignation Mr. Mitten said that owing to his time being so fully occupied with similar undertakings in connection with the street-railway systems at Buffalo and Philadelphia, he should be glad to have his resignation made effective on Dec. 31. During Mr. Mitten's administration the Chicago traction settlement ordinances of 1907 were adopted. By these ordinances the street-railway companies pay into the city treasury 55 per cent of their "net receipts." In the case of the Chicago City Railway Company this payment has amounted, so far, to about a million dollars.

MR. S. GEORGE FREUND has opened an office as a consulting engineer for foreign trade at 100 Broadway, New York. His purpose is to act as a connecting link between American and foreign, especially German, industries in the mutual extension of their technical-commercial relations and the introduction in one country of enterprises and products which have been successful in the other. He is also prepared to assist American and German manufacturers in matters relating to import, export and manufacture and the exploitation of patents. Mr. Freund was connected with the electrical engineering department of the Interborough Rapid Transit Company during the construction of the subway. He has also engaged in other engineering work in this country and since 1901 has been American correspondent for the *Elektrotechnische Zeitschrift.* He has just returned from Europe, where he opened a European office at Grunewaldstrasse, 99, Berlin.

MR. FREDERICK JAMES VOLNEY SKIFF, M.A., LL.D., director of the Field Columbian Museum at Chicago for the past fourteen years, has accepted the appointment of director-in-chief of foreign and domestic participation in the Panama-Pacific International Exposition, which is to be held in San Francisco in 1915. Mr. Skiff is a member of the French Legion of Honor, and has been the recipient of decorations from the governments of Germany, Japan, Belgium, Austria, China, Italy, Turkey, Siam, Bulgaria and Portugal. He was national commissioner of the World's Columbian Exposition, 1893, and later chief of the department of mining and metallurgy and deputy-general of that exposition. He organized the award system of the Nashville Exposition in 1897, and was a director-in-chief of the United States Commission at the Paris Exposition in 1900, commissioner at the Turin Exposition, 1902, and director of exhibits at the Universal Exposition at St. Louis in 1904. He was also first vice-president of the superior jury of the St. Louis Exposition and a member of the board of administration of the International Congress of Arts and Sciences held in connection with that exposition.

MR. ALFRED C. EINSTEIN, for a number of years president of the King Electric Light Company, the St. Louis County Gas Company and the Suburban Electric Light & Power Company, which do the suburban utility business about the city of St. Louis, has been appointed general manager of the Union Electric Light & Power Company, of St. Louis. Mr. Einstein succeeds Mr. Alten S. Miller, who resigned last spring to join Dr. A. C. Humphreys, of Stevens Institute, Hoboken, N. J., in engineering work. The new general manager of the Union Electric Light & Power Company is a native of St. Louis, where he was graduated from the manual training school of Washington University in 1884. After varied engineering experience in railway and mining work, he organized his own construction and engineering company in 1894 for the construction of electric and gas plants. Later he removed to Paducah, Ky., where he served as president and general manager of the electric-light and street-railway properties until 1898. In the following years he invented a number of pieces of acetylene gas-generating apparatus and became president of the Eagle Generator Company, with which he served until 1907. Mr. Einstein had in the meantime become associated with the Suburban Electric Light & Power Company in 1901, and in 1906 purchased the King Elec-

A. C. EINSTEIN.

tric Light Company. Until the appointment of a successor, Mr. Einstein will continue to administer the properties of the St. Louis County corporations, which are owned by the North American Company, the holding concern of the Union Electric Light & Power Company. Mr. James D. Mortimer, president of the Union Electric Light & Power Company, will continue to divide his time between St. Louis and Milwaukee, where he is also general manager of The Milwaukee Electric Railway & Light Company.

Obituary.

MR. FRANK RIDLON, one of the foremost supply dealers in the New England electrical field and a pioneer in the manufacturing branches of dynamo and motor work, died at his home in Brookline, Mass., on Dec. 1, after three years of illness following a paralytic stroke. He was born in Boston in 1838, and at an early age became interested in the study of electricity. For many years he was president of the Frank Ridlon Company, Boston, dealer in electrical supplies and specialist in the maintenance of central-station and railway equipment, holding this office at the time of his death, as well as the presidency of the Berlin (N. H.) Street Railway, which he built, and the Boothbay Harbor Electric Light & Power Company, of Boothbay, Maine. In his earlier days he was the Boston representative of the Brush Electric Company, of Cleveland, Ohio, later becoming connected with the Sun Electric Company, lamp manufacturer, of Woburn, Mass. Twenty-one years ago Mr. Ridlon founded the Boston Electric Light Club, being its president for eight years. At one time he was also vice-president of the National Electric Light Association. In face and figure Mr. Ridlon greatly resembled the late Denman Thompson, the actor, who was his close personal friend. He was for many years a member of the Ancient and Honorable Artillery Company of Boston and was an honorary member of the Hooker Association and Abington Post, G. A. R. He was regarded as the dean of the members of the New England Street Railway Club. A widow and one daughter survive him.

Trade Publications.

TRIPLEX PLUNGER PUMPS.—The Goulds Manufacturing Company, Seneca Falls, N. Y., has issued Bulletin No. 103, describing its single-acting triplex plunger pumps. These are built for working pressures up to 1500 lb. and for a great variety of services.

CONVEYOR SYSTEMS.—The Robins Conveying Belt Company, New York, has issued Bulletin No. 46, containing an illustrated description of its factory equipment, its product and numerous instances of successful applications of belt conveyors, which, it is claimed, are handling in the aggregate at the present time 1,415,000,000 tons of various material annually.

TELEPHONE SUPPLIES AND CONSTRUCTION MATERIAL.—Bulletin No. 1003, published by the Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y., is virtually a catalog of such material used by telephone companies as is considered standard by the trade. It is arranged in conventional style and contains illustrations, short descriptions and prices, besides tables of various kinds of material.

WATERWHEEL ALTERNATORS.—The Westinghouse Electric & Manufacturing Company in Circular No. 1198 describes and illustrates its line of generators, both vertical and horizontal, for waterwheel drive. Several different types of rotor construction are used, each of which is adapted for a certain rotor diameter and speed range. These types of construction are described in considerable detail. Other components of the waterwheel generators receive attention and many pictures of waterwheel-driven installations are shown.

ELECTRIC WASHING AND WRINGING MACHINE.—The Hurley Machine Company, Chicago, has issued a circular describing its "Red Electric" washing and wringing machine, recently designed and placed on the market. The machine is of the dolly type, but its special feature is the method of operating the dolly. All of the gearing and operating mechanism is mounted under the machine on a metal platform. The dolly in the machine is operated by an upright shaft extending up through a hollow sleeve in the bottom of the tub, which leaves the sides of the machine as well as both the inside and outside of the cover entirely free from any mechanism to interfere with the operator.

BUSINESS NOTES.

THE ALLIS-CHALMERS COMPANY has removed its Kansas City office to 1410-12 Waldheim Building.

NEW CUT-OUT CABINETS.—The New England Electric Company, of Denver, Col., has developed a line of adjustable-flange cut-out cabinets designed to be used flush with the plaster line and involving but a small amount of adjustment subsequent to installation.

MONKS & JOHNSON, architects and engineers, 7 Water Street, Boston, have associated themselves with Henry F. Keyes, architect, 161 Devonshire Street, Boston, for the preparation of plans and specifications for certain large industrial developments.

SPLITDORF AGENCIES.—Following removal to new quarters in Chicago and the establishment of a branch in Kansas City, the former quarters of C. F. Splitdorf in San Francisco have had to be abandoned owing to the lack of proper facilities for handling the volume of ignition business, and P. E. Kempton, branch manager on the Coast, will now be located in new headquarters at 430-436 Van Ness Avenue.

NEW DETROIT OFFICE OF FOSTORIA GLASS SPECIALTY COMPANY.—The Fostoria Glass Specialty Company, of Fostoria, Ohio, has recently opened a branch office at 414 Bowles Building, Detroit, Mich., where a large exhibit of its electric and gas shades and reflectors and of its other products will be kept on display. The office is in charge of Mr. H. E. Richards, who is well known to the fixture trade of the Middle West.

ADAMS-BAGNALL CHANGES.—Mr. J. G. Pomeroy, formerly Western sales manager of the Adams-Bagnall Electric Company, has been appointed sales manager of the company with headquarters in Cleveland. Mr. C. L. Eshleman has been appointed publicity manager of the company with headquarters in Cleveland. The company has opened a Boston office under the management of Mr. E. R. Bryant, formerly connected with the company's New York office. A stock of all Adams-Bagnall lines will be carried in Boston.

MR. J. ALLEN WORTH has recently resigned from the Weber Electric Company to become sales manager of the push-button switch and specialty department of the Cutler-Hammer Manufacturing Company, of Milwaukee. Mr. Worth has been engaged in this field of the electrical industry for the past seven years. He, with Mr. Henry D. Sears, sales agent for the Weber company, successfully marketed the first snapshell socket at a time when the trade was skeptical of the utility of this type. Mr. Worth's experience with the Weber company since this time fits him for the sales management of the rapidly growing Cutler-Hammer line of switches and specialties.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED DEC. 5, 1911.

[Prepared by Robert Starr Allyn, 16 Exchange Place. New York.]

1,010,409. APPARATUS FOR USE IN THE DISTRIBUTION OF ELECTRIC CURRENTS; A. F. Berry, Ealing, England. App. filed March 14, 1910. Transformer system improvements over Patents Nos. 796,555 and 800,538.

1,010,410. APPARATUS FOR USE IN THE DISTRIBUTION OF ELECTRIC CURRENTS; F. E. Berry, Hayes, England. App. filed May 6, 1911. Transformer system with successive switch operation.

1,010,412. SPEED-LIMIT-SIGNALING APPARATUS; F. M. Butler, David City, Neb. App. filed Jan. 21, 1910. Visible and audible signals for automobiles, etc.

1,010,413. TRANSMITTING APPARATUS FOR TELEGRAPH SYSTEM; A. C. Crehore, Yonkers, N. Y. App. filed July 23, 1904. For keyboard-operated system of Patent No. 773, 198.

1,010,414. THERMOSTAT; A. S. Cubitt, Pittsfield, Mass. App. filed June 16, 1910. Thermostatic switch and thermostatic lock to produce snap action.

1,010,415. COMBINED WATCHMAN'S CLOCK AND TELEPHONE SYSTEM; F. G. Duryee, Fort Wayne, Ind. App. filed March 8, 1910. Recording clock and time-limit device for calling the operator.

1,010,416. ELECTRICITY METER; S. Evans, Berlin, Germany. App. filed June 3, 1908. Indicates the maximum rate of consumption.

1,010,420. SYSTEM OF DISTRIBUTION; J. J. Frank, Pittsfield, Mass. App. filed Jan. 26, 1911. Busbars of different potential for "life-testing" incandescent lamps.

1,010,422. CIRCUIT-BREAKER; W. P. Hamlyn, Rugby, England. App. filed Nov. 30, 1907. Automatic free-handle type.

1,010,425. ELECTRIC SWITCH; E. M. Hewlett, Schenectady, N. Y. App. filed March 20, 1909. Protected tower switch for dividing a high-potential transmission line into sections.

1,010,448. PROCESS OF TREATING COILS; J. I. Mitchell, Pittsfield, Mass. App. filed March 12, 1910. The coils are japanned, then wound with tape and then oil-proofed.

1,010,449. SANITARY TELEPHONE TRANSMITTER; J. H. O'Connell, Boston, Mass. App. filed Dec. 5, 1908. Thin, imperforate front plate.

1,010,455. MERCURY-VAPOR LAMP; A. E. Richardson, Lynn, Mass. App. filed June 12, 1905. Starting filament moved by an electromagnet.

1,010,465. CLUSTER SOCKET; J. C. Tournier, Schenectady, N. Y. App. filed March 5, 1909. For series or multiple connection.

1,010,466. SYSTEM OF ELECTRICAL DISTRIBUTION; W. E. Ver Planck, Schenectady, N. Y. App. filed July 2, 1908. Railway-train lighting generator on the locomotive or in the baggage car with storage battery.

1,010,471. TELEPHONE SYSTEM; C. S. Winston, Chicago, Ill. App. filed April 15, 1907. Two-conductor cord circuit with impedance.

1,010,478. SUBSCRIBER'S TELEPHONE APPARATUS; H. P. Clausen, Chicago, Ill. App. filed March 23, 1903. Party-line automatic selective-system signaling for so-called "automatic" systems.

1,010,497. ELECTRICAL SYSTEM OF DISTRIBUTION; A. S. Hubbard, Belleville, N. J., and E. Van Wagenen, New York, N. Y. App. filed Dec. 27, 1906. Alternating-current system with storage-battery regulation. (Sixty-nine claims.)

1,010,500. TRANSFORMER; S. E. Johannesen, Pittsfield, Mass. App. filed Jan. 26, 1911. "Bell-ringing" type; the core may be used as a resistance.

1,010,504. THIRD-RAIL COVERING; F. H. Lindsley, Pawtucket, R. I. App. filed March 20, 1911. Side-guard plates.

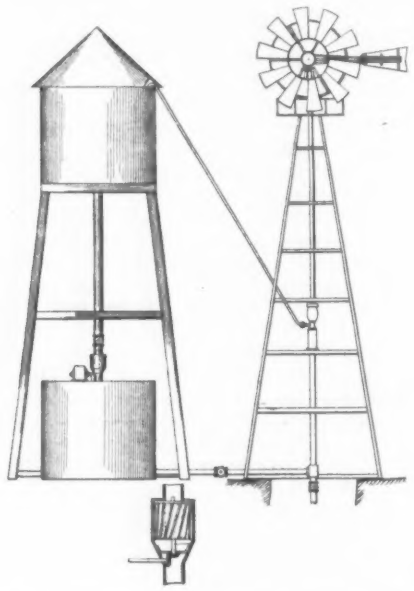
1,010,505. TELEPHONE SYSTEM; R. H. Manson, Elyria, Ohio. App. filed Oct. 9, 1907. Automatic line meter for measured service.

1,010,522. DYNAMO-ELECTRIC MACHINE; H. Roos, Berlin, Germany. App. filed April 29, 1910. Ventilated rotating field magnet for turbo-generators.

1,010,529. ELECTRICALLY HEATED TOOL; G. E. Stevens, Lynn, Mass. App. filed Sept. 16, 1908. Soldering iron.

1,010,531. TELEPHONE INSTRUMENT; W. F. Taylor and V. Durbin, Brookline, Mass. App. filed May 17, 1909. Readily dismemberable desk standard transmitter.

1,010,533. DYNAMO-ELECTRIC MACHINE; E. M. Tormin, Brookline, Mass. App. filed June 17, 1910. Alternating-current generator for delivering different cycles for party-line telephone signaling.



1,010,591.—Apparatus for Generating Electric Currents.

1,010,590. TELEPHONE TRANSMITTER; H. P. Clausen, Chicago, Ill. App. filed Aug. 20, 1902. Plural diaphragm microphone type.

1,010,591. APPARATUS FOR GENERATING ELECTRIC CURRENTS; W. B. Clements, Veedum, Wis. App. filed Dec. 13, 1909. Windmill-driven pump and turbo-generator.

1,010,592. INSULATING BUSHING FOR ELECTRIC CONDUCTORS AND BINDING-POSTS; F. W. Cole, Newton, Mass. App. filed April 15, 1910. Detachable bushing.

1,010,593. WIRELESS-TELEPHONY APPARATUS; V. Colin and M. Jeance, Neuilly-sur-Seine and Paris, France. App. filed Aug. 18, 1909. A series of special arc lamps.

1,010,606. COMBINATION LIGHTNING ARRESTER AND FUSE BLOCK; E. B. Fahnestock, New York, N. Y. App. filed Feb. 19, 1907. The fuse is supported only at the lower end.

1,010,620. ELECTRIC SWITCH; W. J. Crumpton, Superior, Wis. App. filed April 3, 1905. Inclosed and sealed mercury terminal.

1,010,638. ELECTROPLATING RACK; J. F. Kitchen, Meadville, Pa. App. filed June 26, 1909. Perforated yoke, cathode hanger.

1,010,639. ELECTROPLATING RACK; J. F. Kitchen, Meadville, Pa. App. filed June 26, 1909. Reel-like frame for strips, wire, corset stays, etc.

1,010,640. SWITCH DEVICE; O. K. Kjolseth, Schenectady, N. Y. App. filed Aug. 1, 1905. A switch and fuse for electric locomotive protection.

1,010,641. RESISTANCE UNIT; C. D. Knight, P. H. Zimmer and J. B. Ford, Schenectady, N. Y. App. filed Feb. 21, 1907. The resistance is embedded in an asbestos tube with porcelain ends.

1,010,647. ELECTROPLATING RACK; C. E. Leffel, Meadville, Pa. App. filed June 26, 1909. A covered cathode hanger with hooks.

1,010,648. ELECTROPLATING RACK; C. E. Leffel, Meadville, Pa. App. filed June 26, 1909. A non-conducting cathode hanger with hooks.

1,010,651. TROLLEY-POLE ARRESTER; R. S. Lillico, Seattle, Wash. App. filed Oct. 17, 1910. Jumping of the pole releases a retrieving weight.

1,010,663. ELECTRIC CIRCUIT CONTROLLER; A. Meadows, Detroit, Mich. App. filed Oct. 31, 1910. Permutation lock to protect motor-vehicle ignition circuits, etc.

1,010,666. COMMUTATOR SWITCH; R. Miller, Ann Arbor, Mich. App. filed Sept. 28, 1910. For controlling the lighting of the two front lamps and the tail lamp of a motor vehicle.

1,010,668. VACUUM-TUBE LAMP; D. McF. Moore, Newark, N. J. App. filed Jan. 5, 1905. A portion of the electrode is heated by current independent of the discharge.

1,010,669. WIRELESS-TELEGRAPH APPARATUS; D. McF. Moore, Newark, N. J. App. filed May 8, 1906. Vacuum-tube receiver with automatic valve.

1,010,670. AUTOMATIC GAS-FEED FOR VACUUM TUBES; D. McF. Moore, Newark, N. J. App. filed May 8, 1906. By varying the temperature and porosity of a platinum tube.

1,010,693. BATTERY-ELEMENT SUPPORT; C. B. Schoennehl, Waterbury, Conn. App. filed Nov. 26, 1909. A disk of compressed copper oxide with a hanger.

1,010,695. BATTERY VENT PLUG; J. R. Sloan, Altoona, Pa. App. filed June 9, 1911. A covered gas passage.

1,010,702. SECTIONAL ROD; W. H. Stewart, Boston, Mass. App. filed April 19, 1909. For fishing conduits, etc.

1,010,722. INSULATED ADJUSTABLE TROLLEY CROSSING; H. W. Clapp and B. C. Edgar, San Francisco, Cal. App. filed March 18, 1911. For adaptation to different angles of cross-over.

1,010,753. ELECTRIC SWITCH; E. A. Halbleib, Rochester, N. Y. App. filed Dec. 16, 1910. Plurality of plugs with a key-locking device.

1,010,757. PULSOMETER; H. E. Heath, Hartford, Conn. App. filed Sept. 24, 1908. Spring arms having different natural rates of vibration.

1,010,777. OZONIZER; R. M. Leggett, Ann Arbor, Mich. App. filed Jan. 21, 1911. Tubular terminals and dielective.

1,010,814. COMBINATION LOCK FOR ELECTRIC LAMPS AND THE LIKE; G. I. Silbert, Chicago, Ill. App. filed July 18, 1910. Tumblers and a setting ring.

1,010,864. SWITCH INSTRUMENT; C. W. Coleman, Westfield, N. J. App. filed Oct. 9, 1909. The movement of a railway switch controls the block-signal circuits.

1,010,866. PROCESS OF MAKING COMPOSITE CONDUCTORS; W. D. Coolidge, Schenectady, N. Y. App. filed Sept. 23, 1908. A thoria thread is copper-coated, then covered with tungsten. The copper is then driven off.

1,010,899. TROLLEY; G. Frivalszky, Chicago, Ill. App. filed June 10, 1911. The wheel has spiral replacing beads.

1,010,897. ELECTRIC GAS-LIGHTER; H. D. Grinnell, Pittsfield, Mass. App. filed July 14, 1910. For motor-vehicle lamps.

1,010,891. SOLDERING IMPLEMENT; C. W. Gamble, Montreal, Canada. App. filed Aug. 16, 1911. The tool is adapted to be readily attached to a current-supplying standard.

1,010,900. ARC LAMP; C. A. B. Halvorson, Jr., Lynn, Mass. App. filed March 7, 1907. Plural flaming arcs with feed and control.

1,010,907. METHOD OF PREVENTING ALTERNATING-CURRENT ELECTROLYSIS; J. L. R. Hayden, Schenectady, N. Y. App. filed Jan. 4, 1907. The negative wave is made to overbalance and neutralize the positive destructive wave.

1,010,914. MACHINE FOR TREATING FILAMENTS; J. W. Howell, Newark, N. J. App. filed Oct. 17, 1903. The treating "bottle" is automatically charged with the proper amount of hydrocarbon.

1,010,920. HIGH-TENSION INSULATOR; B. D. Kenney, East Liverpool, Ohio. App. filed June 29, 1911. Suspended units have hinged connectors.

1,010,922. TROLLEY; C. and J. Kordek, Philadelphia, Pa. App. filed Sept. 1, 1911. Has side guide rollers above and behind the wheel.

1,010,936. ELECTRIC CONDENSER; M. Meirowsky, Cologne-Ehrenfeld, Germany. App. filed March 3, 1909. Sheets of tinfoil are rolled between layers of prepared paper while hot.

1,010,937. OIL SWITCH; J. F. Mennington, Oakley, Ohio. App. filed Dec. 30, 1907. Pivoted arms with ball and socket contacts.

1,010,938. RIVETING MACHINE; F. R. von Merkl, Vienna, Austria-Hungary. App. filed June 4, 1910. Magnetic clutch drive.

1,010,942. ARC-LIGHT ELECTRODE; B. Monasch, Berlin, Germany. App. filed Jan. 2, 1908. Iron anode with copper core and iron cathode with titanium oxide core.

1,010,961. SYSTEM OF DISTRIBUTION; G. B. Schley, Norwood, Ohio. App. filed Feb. 6, 1908. Multiple voltage system. (Improvement in Hall patent No. 883,195.)

1,010,982. NEUTRALIZING INDUCTIVE DISTURBANCES; J. B. Taylor, Schenectady, N. Y. App. filed Nov. 19, 1908. The current in the outgoing and return conductors is maintained equal by electromagnetic means.

1,010,984. ATTACHMENT PLUG; G. B. Thomas and F. E. Seeley, Bridgeport, Conn. App. filed July 25, 1911. The plug and fitting are relatively rotarily adjustable.

1,010,985. ELECTRIC-LAMP SOCKET; G. B. Thomas, Bridgeport, Conn. App. filed Aug. 11, 1911. A side-screw multiple is mounted on the porcelain inside the shell.

1,010,990. REGULATING DEVICE; E. A. Wagner, Fort Wayne, Ind. App. filed April 29, 1909. A transformer and reactance for regulating moving-picture-machine lights, etc.

1,010,998. DYNAMO-ELECTRIC MACHINE; R. B. Williamson, Milwaukee, Wis. App. filed April 22, 1910. Reinforced turbo-generator rotor.

1,011,018. METHOD OF INCREASING THE WORKING FACTOR (COS ϕ) AND THE STABILITY OF ELECTRIC FURNACES; K. Birkeland, Christiania, Norway. App. filed April 16, 1910. The current is divided into parts in parallel and out of phase.

1,011,020. NEUTRALIZING INDUCTION FROM ALTERNATING-CURRENT RAILWAYS; W. S. Bralley, Schenectady, N. Y. App. filed Aug. 7, 1907. A neutralizing conductor is placed near the conductors to be protected and connected in shunt to the rails.

1,011,045. SOUND INTENSIFIER FOR TELEPHONE MOUTHPIECES AND THE LIKE; H. Foss, Dombaas, Norway. App. filed Aug. 24, 1909. Spherical sound box.

1,011,088. ELECTRIC LIGHTING; C. P. Steinmetz, Schenectady, N. Y. App. filed April 25, 1900. Starting lamps requiring high starting voltage.

1,011,097. CIRCUIT-BREAKER; H. L. Van Valkenburg, Norwood, Ohio. App. filed Sept. 14, 1905. Magnetic and hand-operated.

1,011,118. INSULATING DEVICE FOR ELECTRIC CABLES; P. Carolan, Cleveland, Ohio. App. filed Dec. 9, 1910. Splicing device with a protection fuse.